VOLUME 52 NUMBER 2 AUGUST, 1961

# AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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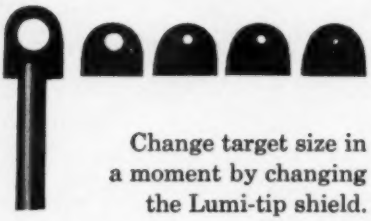

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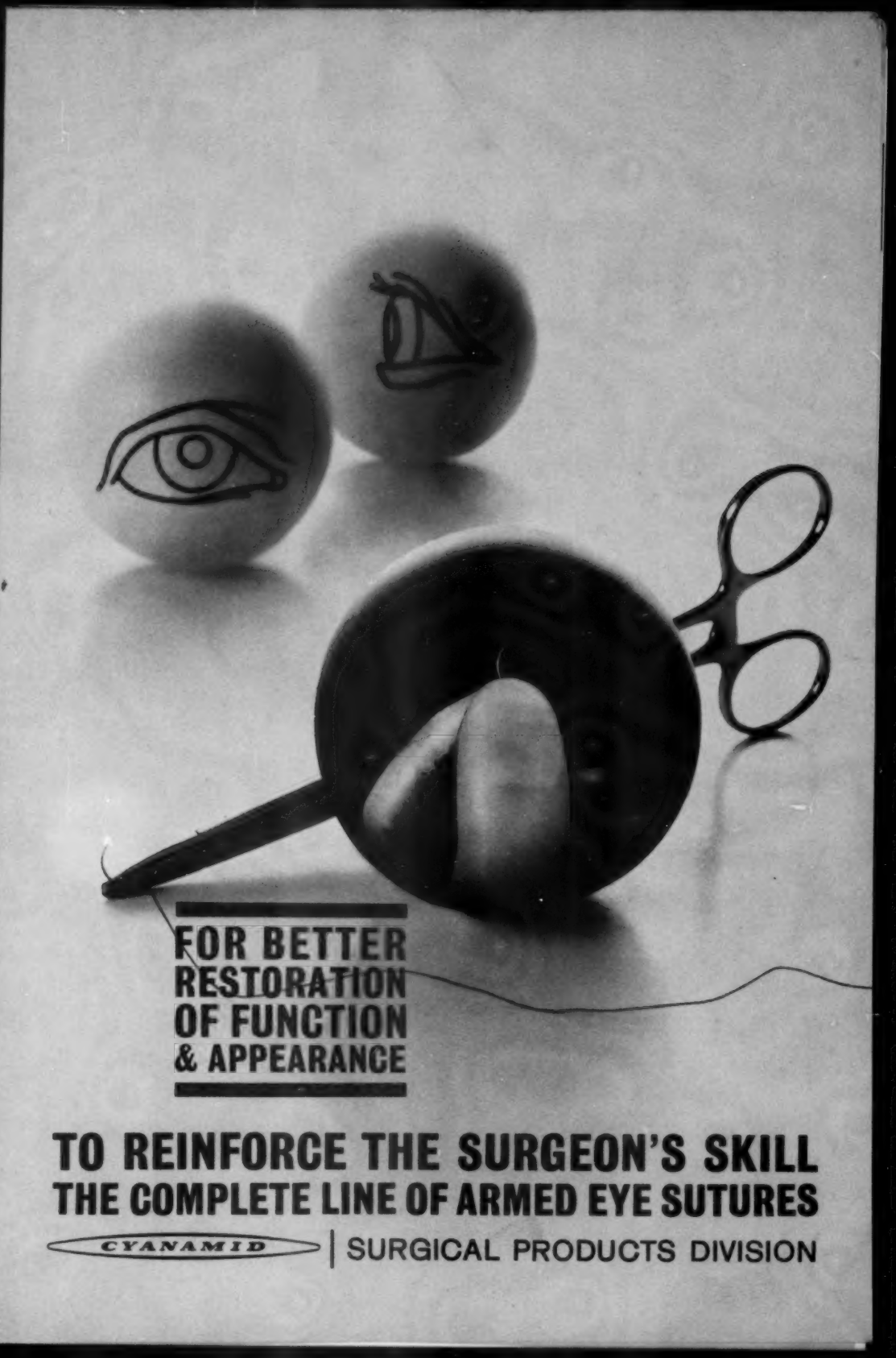
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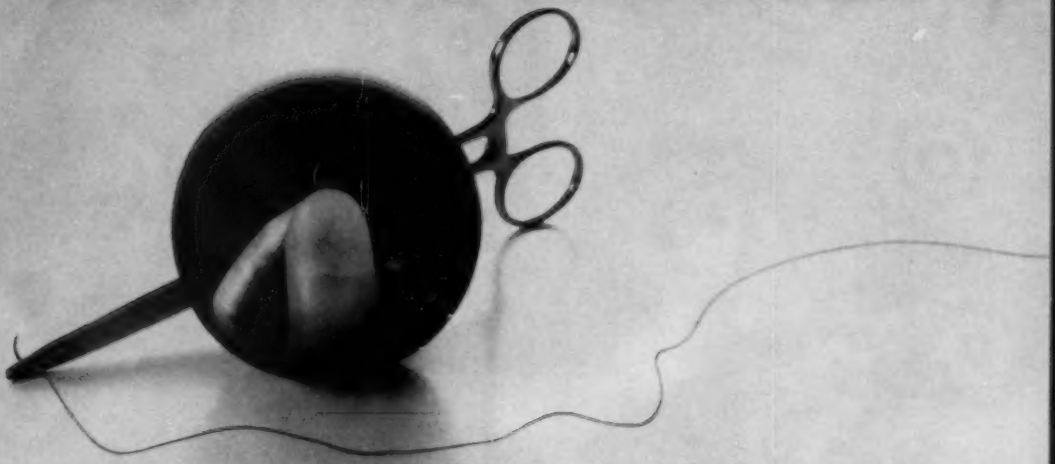

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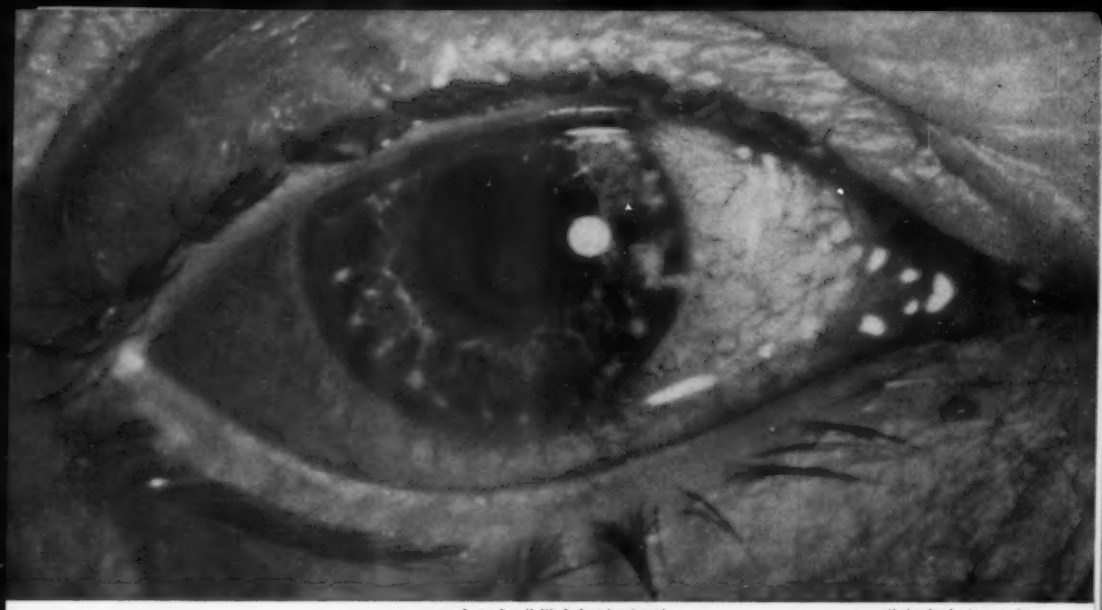

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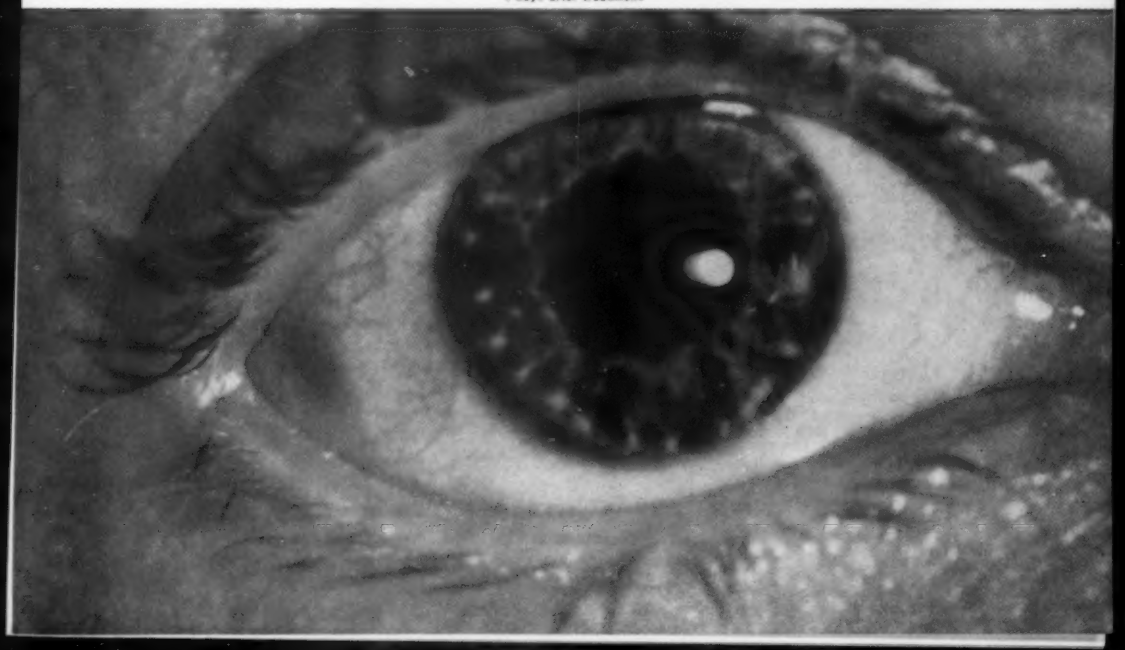

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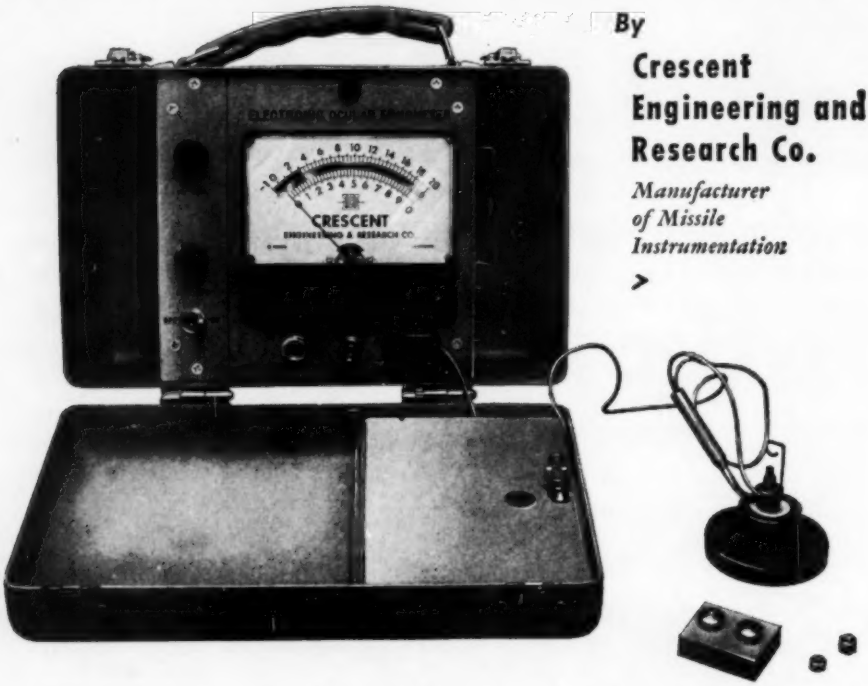


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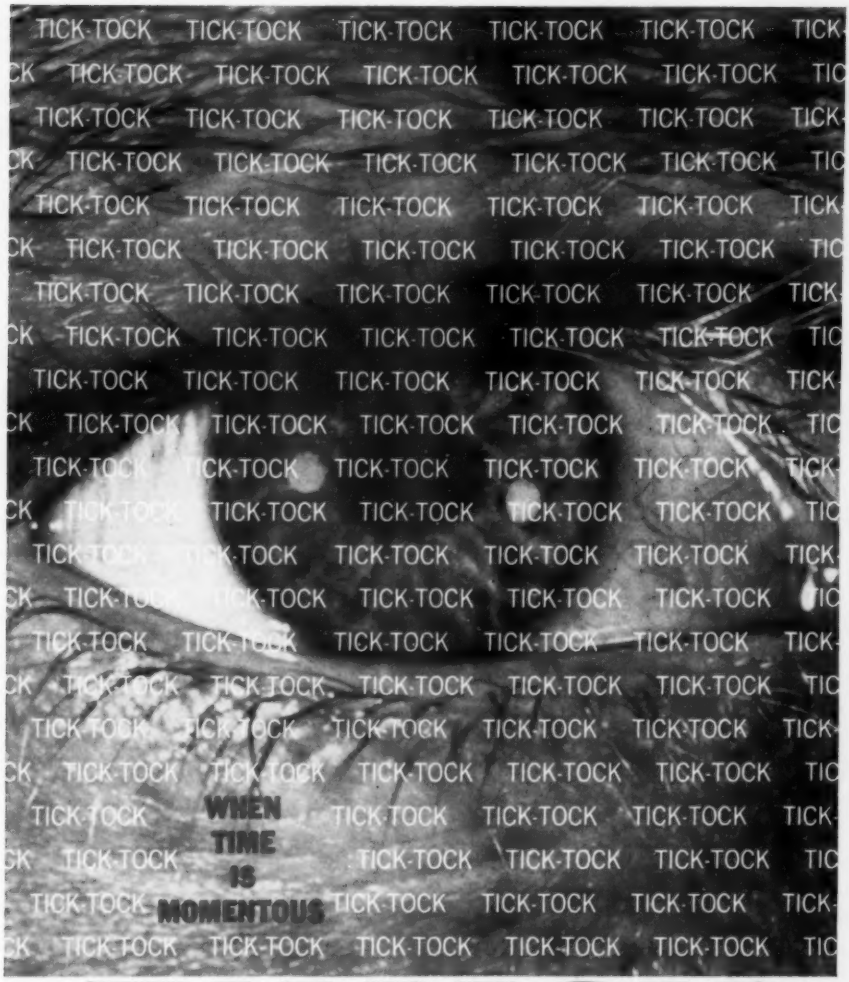


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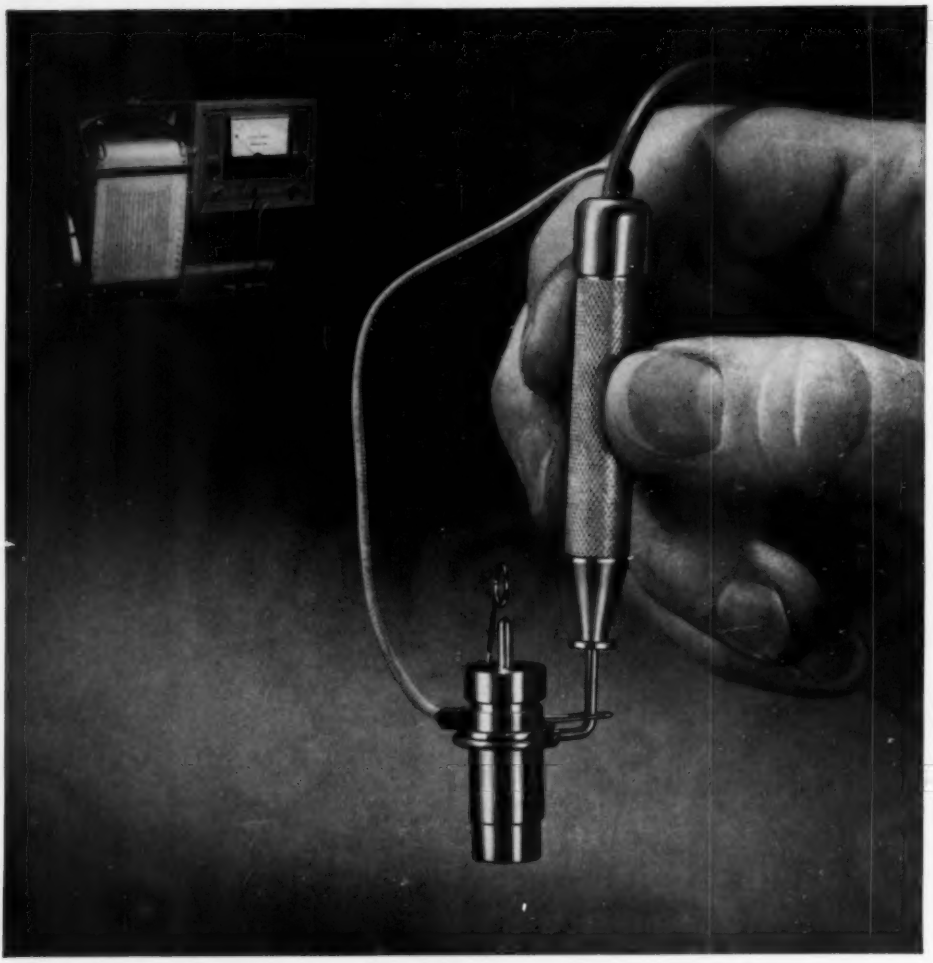

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*References:* (1) Morrison, W. H.: *Nebraska M. J.* **45**:106, 1960. (2) Perkins, E. S.: *Practitioner* **178**:575, 1957. (3) Tassman, W. S.: *U. S. Armed Forces M. J.* **10**:161, 1959. (4) Kamiya, S.: *Am. J. Ophth.* **42**:269, 1956. (5) Holland, R. W. B.: *Arch. Ophth.* **57**:214, 1957. (6) Benton, C. D., Jr.: *South M. J.* **51**:1562, 1958. (7) Blakiston's New Gould Medical Dictionary, ed. 2, New York, McGraw-Hill Book Company, Inc., 1956, p. 945. (8) Ostler, H. B., & Braley, A. E.: *J. Iowa M. Soc.* **44**:427, 1954.

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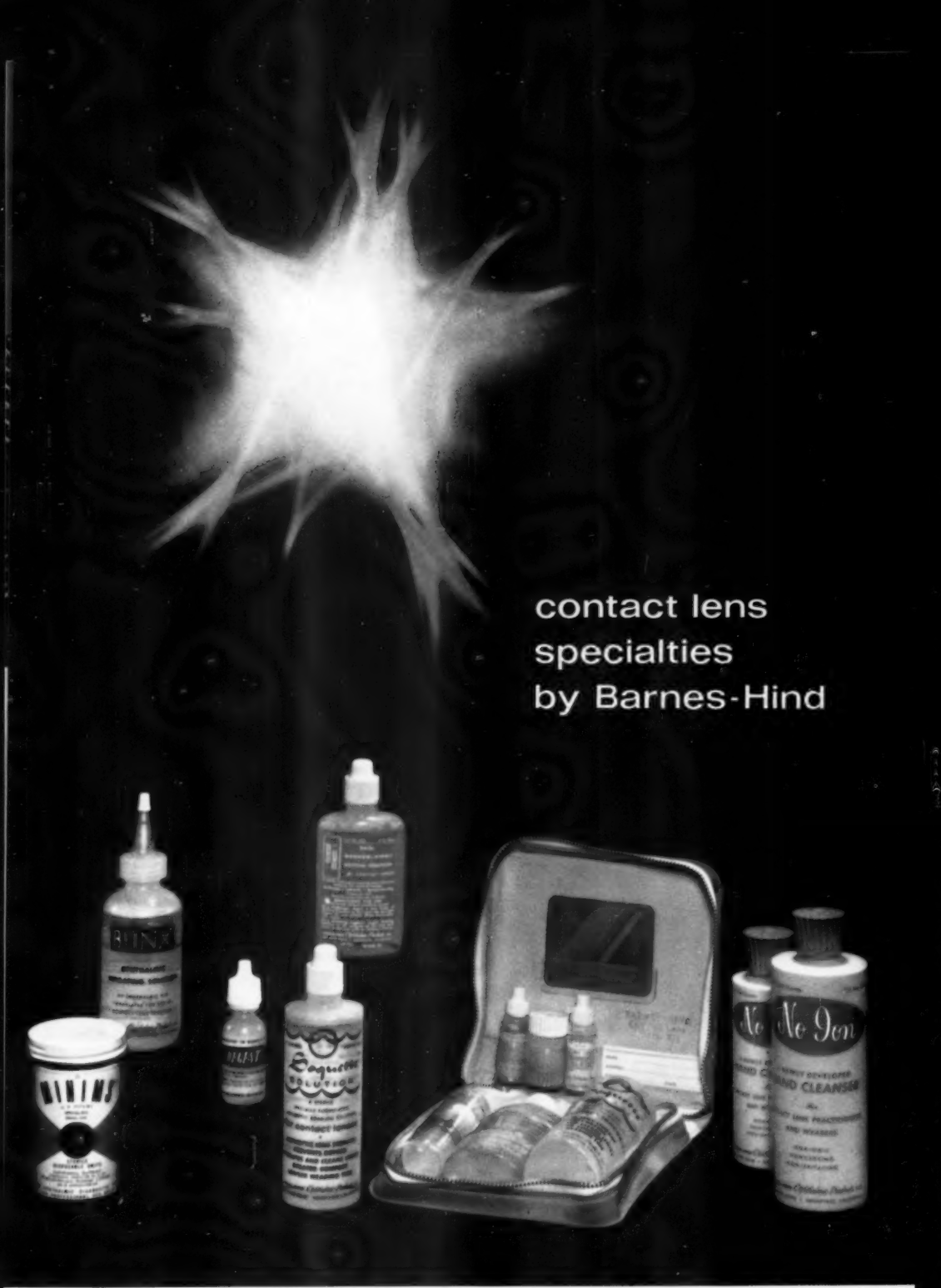


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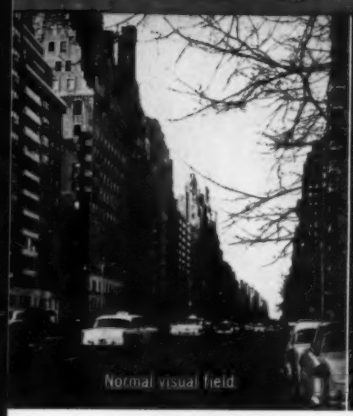
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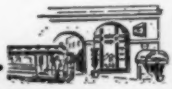

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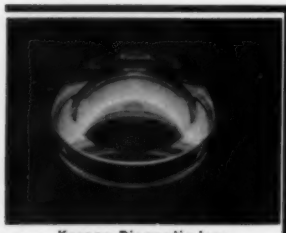

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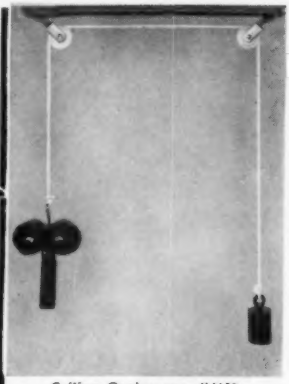

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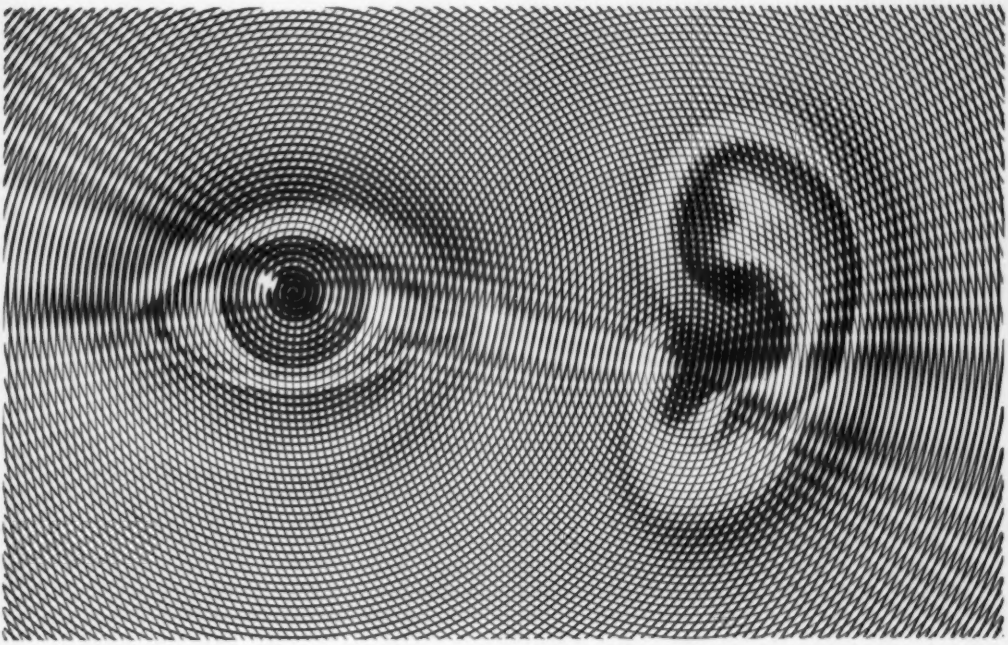

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NEO-ARISTOCORT provides excellent topical therapy combining the efficacy of Triamcinolone Acetonide . . . an agent of choice where topical corticosteroid is indicated* . . . and Neomycin . . . outstanding topical antibiotic.

NEO-ARISTOCORT EYE-EAR OINTMENT contains: Triamcinolone Acetonide 0.1% and Neomycin Sulfate (0.35% neomycin base) 0.5% as the active ingredients; and light liquid petrolatum N.F. 15%, wool fat U.S.P. 10%, and white petrolatum U.S.P. q.s. w/v 100% as the inactive ingredients.

*Precautions* – Contraindicated in herpes simplex. Sensitivity reactions to neomycin occasionally occur.

Tubes of ⅛ oz.

*Witten, V. H.; Sulzberger, M. B., and Arthur, G. W.: *Clin. Pharmacol. & Therap.* 1:294 (May-June) 1960.

Lederle

**LEDERLE LABORATORIES**
**A Division of AMERICAN CYANAMID COMPANY**
**Pearl River, New York**

In a series[1] of 87 cases of retinal hemorrhages, vitreous hemorrhages or vitreous floaters, the use of IODO-NIACIN* Tablets was followed by both subjective and objective improvement.

Ocular hemorrhages, as photographed ophthalmoscopically, were absorbed rapidly. Large vitreous floaters diminished in size and often disappeared entirely. The controls, treated with a placebo, showed no comparable benefit.

- RETINAL HEMORRHAGES
- VITREOUS HEMORRHAGES
- VITREOUS FLOATERS

**IODO-NIACIN** has been found to be effective in cerebral and generalized arteriosclerosis[2]. There are no symptoms of iodism or other ill effect even when the medication is continued in full dosage for a year or longer.

**IODO-NIACIN** Tablets contain potassium iodide 135 mg. and niacinamide hydroiodide 25 mg. The recommended dosage for ocular conditions is 1 tablet t.i.d. No iodism occurs with prolonged use of a dosage of 8 tablets daily.

**IODO-NIACIN** Ampuls, for intramuscular or slow intravenous injection, have been shown to provide the same therapeutic effects[3] as the tablets. Indicated for rapid and intensive action.

**IODO-NIACIN***

*U.S. Patent Pending.

1. Abrahamson, I. A., Jr. & Abrahamson. I. A., Sr., *Am. J. Ophth.* (Insert vol.:page), 1956.
2. Feinblatt, T. M., Feinblatt, H. M. & Ferguson, E. A., *Am. J. Digest. Dis.* 22:5, 1955.
3. Feinblatt, T. M., Feinblatt, H. M. & Ferguson, E. A., *Med. Times*, 84:741, 1956.

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Gentlemen: Please send me professional literature covering IODO-NIACIN Tablets and Ampuls, also samples of the tablets.

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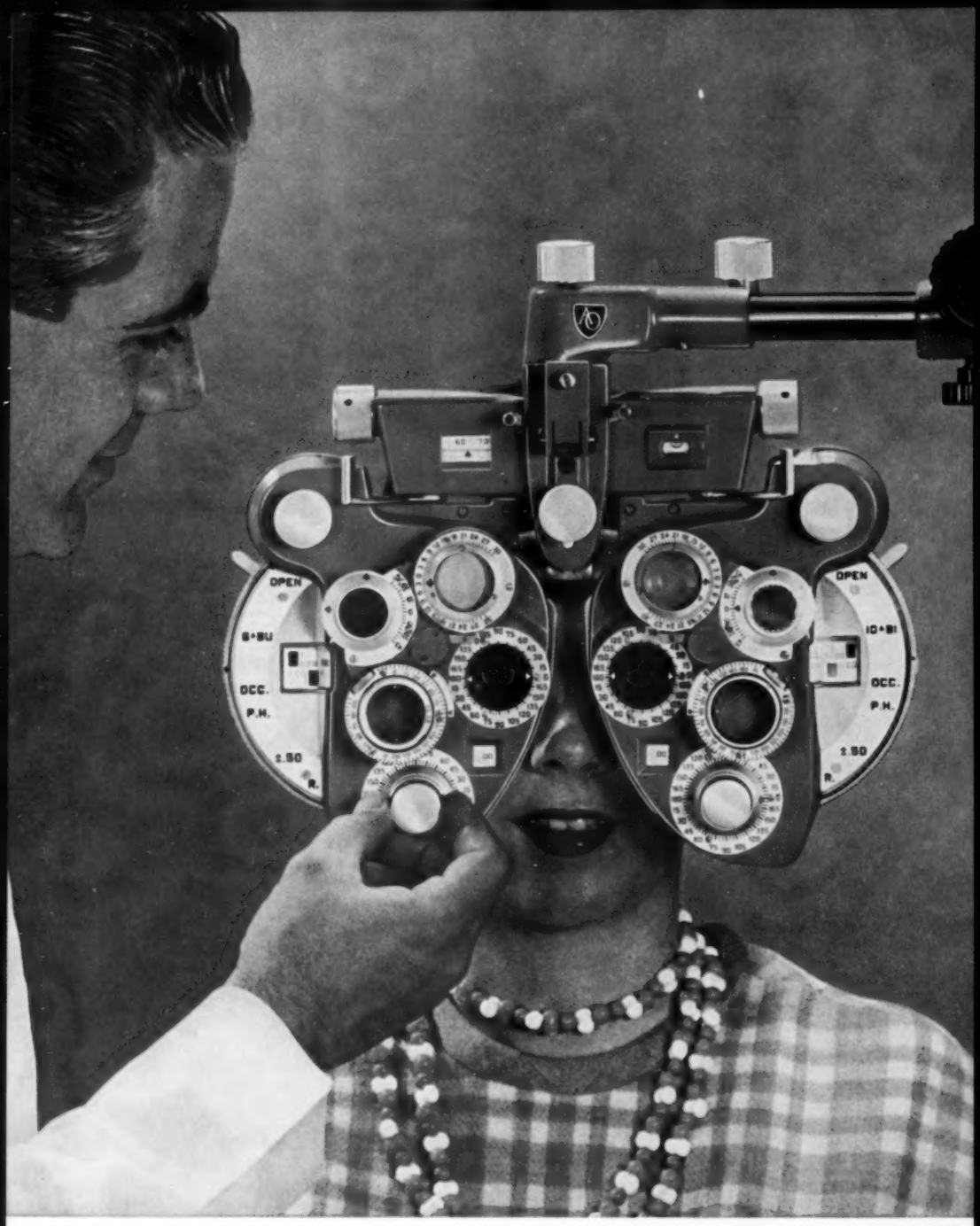
City ..... Zone ..... State .....

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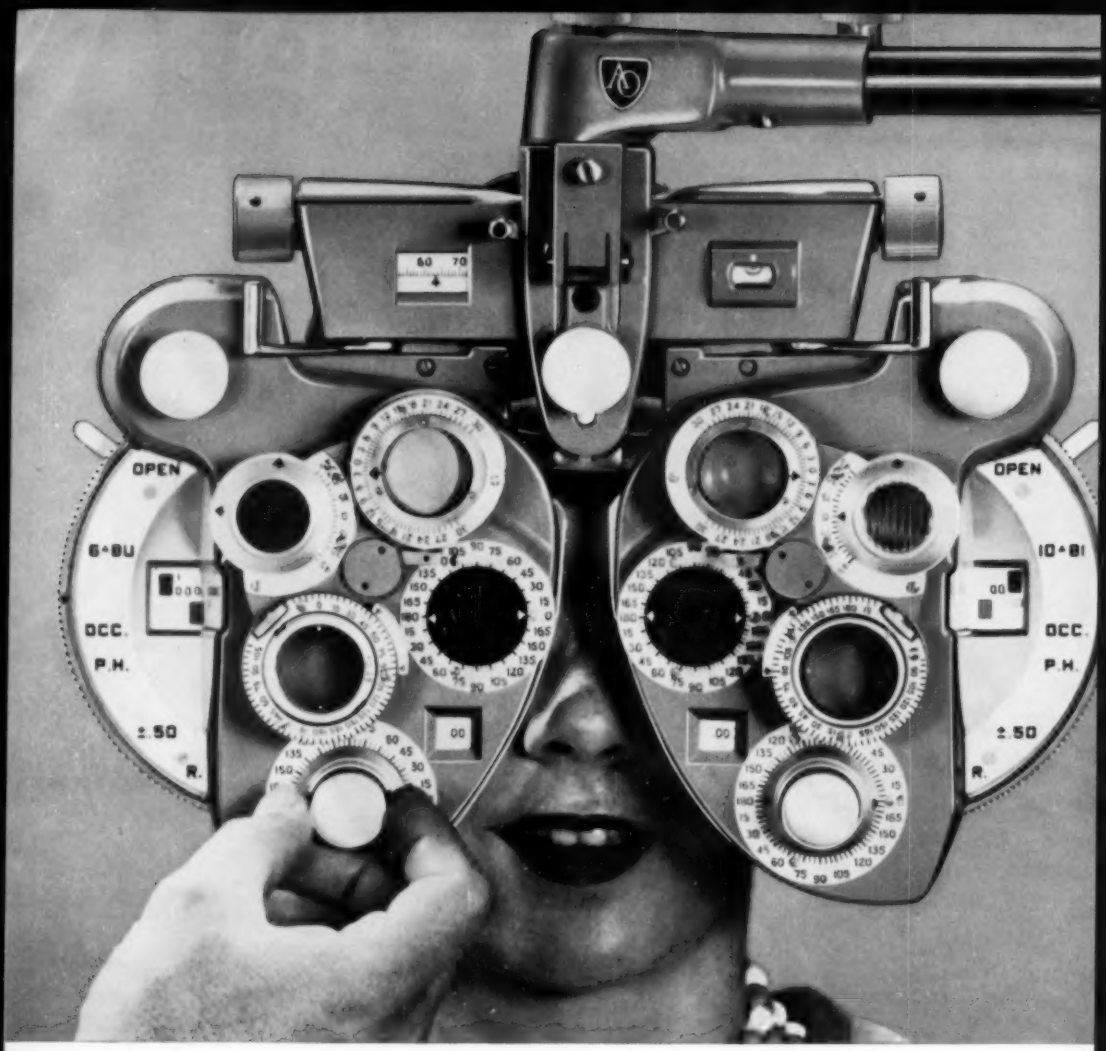


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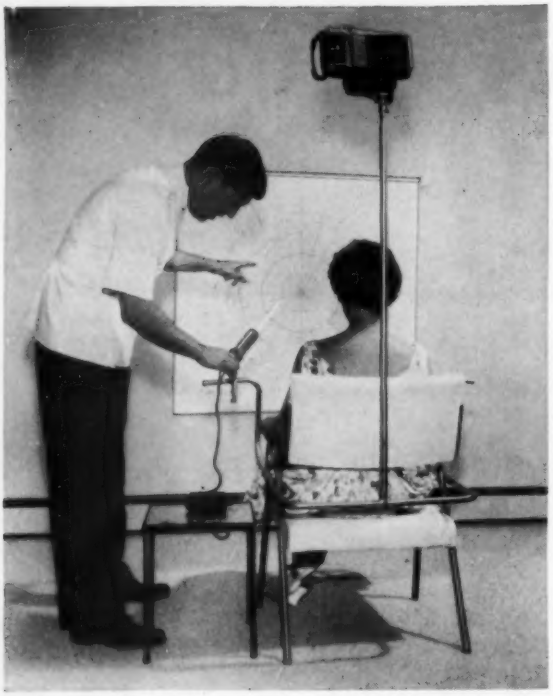
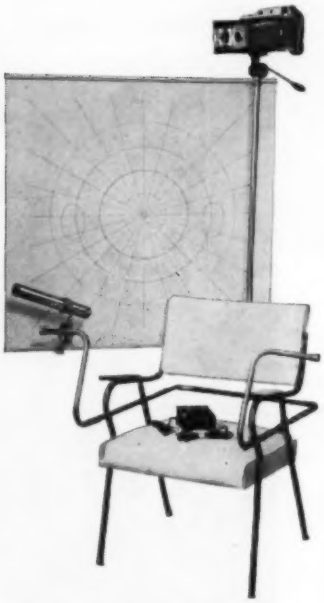
# NEW AUTOMATIC METHOD FOR PLOTTING *central visual field*



- *quicker*
- *easier*
- *greater accuracy*

## ALLIED PHOTO FIELD PLOTTING UNIT



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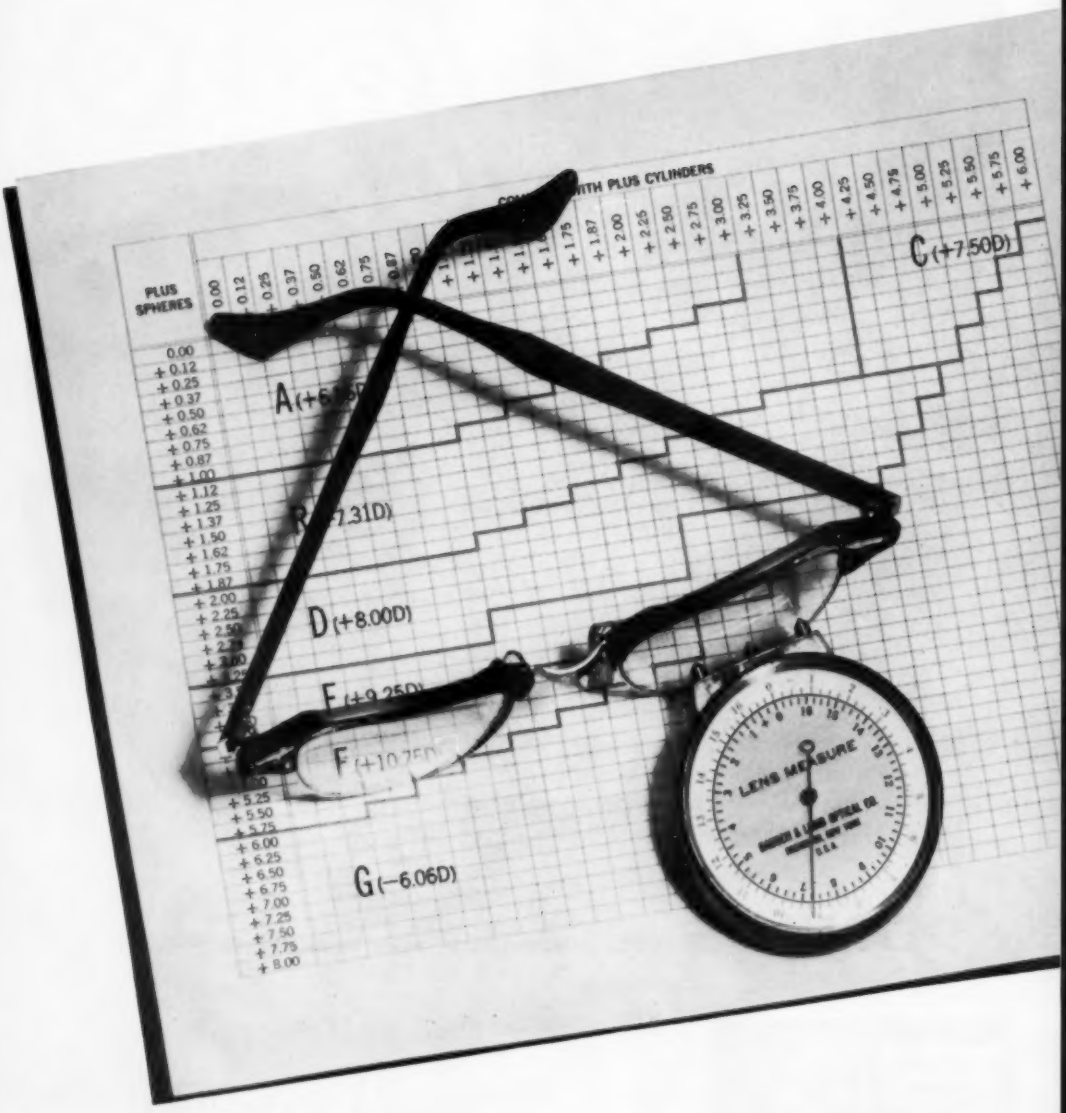

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There's no confusion about vision quality for your patients when you prescribe Orthogon marginally corrected lenses.

**1** You *know* the exclusive benefits of the Orthogon system: not compromise correction, but correction for marginal astigmatism, the one aberration for which the human eye cannot compensate. The Orthogon principle of marginal correction is not a matter of manufacturing expedience; of changing correction factors in various ranges—a pinch of this and a pinch of that.

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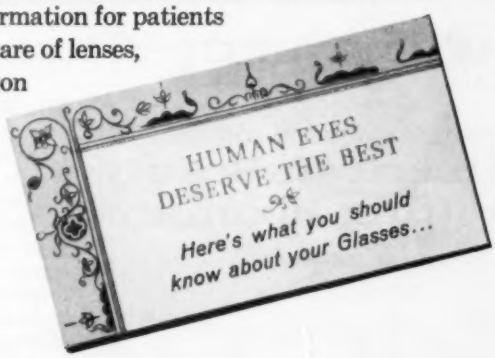


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Why? Because your patients instinctively judge you and your ability from the moment they enter your office . . . and American Beauty furniture is specifically designed to create the right professional impression at this time.

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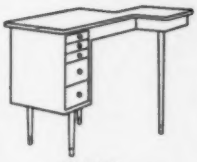
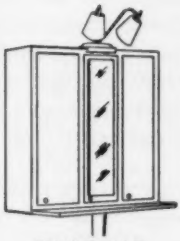


TABLE

PATIENT CHAIR



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at a glance how highly you regard their comfort.

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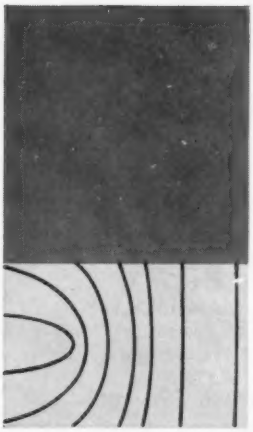
# WITH EACH OPERATION NOW FULLY AUTOMATED!



Yes, there's a reason why PC lenses are so uniformly accurate . . . so beautifully finished . . . so comfortable. The reason is—

**No NONSCLERAL® lens is left to hand guesswork. Each operation is fully automated—with devices created and produced in our own laboratories.**

The optical surface of the lens is untouched in production by human hands from beginning to final inspection. Automation results in these practical advantages—

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- *reduces production and servicing time*
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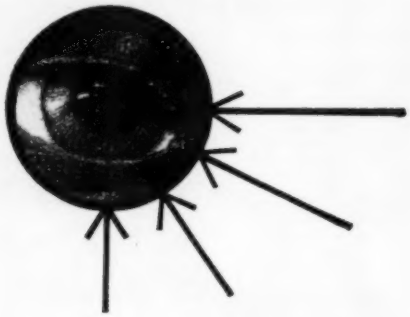

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considered outstanding in ophthalmic surgery[2]

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• produces anesthesia within 2-5 minutes. ...duration of anesthesia 30 to 50 minutes.[2]

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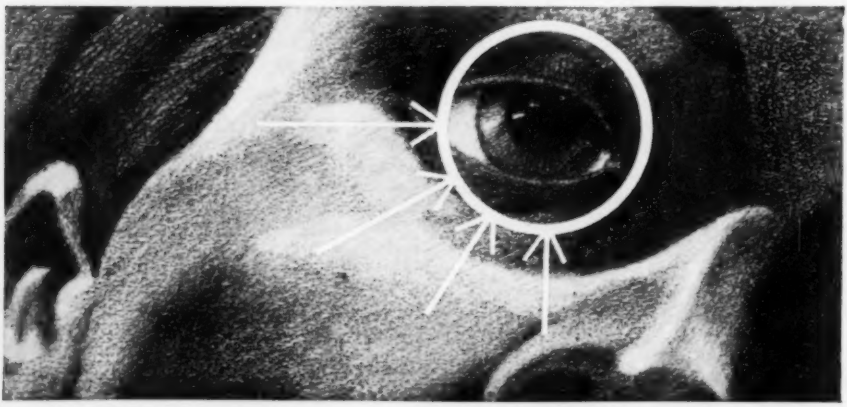
1. Swan, K. C.: Tr. Am. Acad. Opth. *60*:368, 1956.
2. Arora, R. B., et al.: E. E. N. T. Monthly *34*:593, 1955.
3. Florestano, H. J., and Bahler, M. E.: J. Am. Pharm. A. (Scient. Ed.) *45*:360, 1956.



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Topical hydrocortisone provides symptomatic relief of edema, pain and photophobia, and curbs neovascularization, while polymyxin B and neomycin eradicate most pathogens invading the eye, including Pseudomonas.

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Each cc. contains:

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| 'Aerosporin'® brand Polymyxin B Sulfate | 10,000 Units |
| Neomycin Sulfate | 5 mg. |
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Indicated in bacterial, allergic, vernal and phlyctenular conjunctivitis; blepharitis; episcleritis; iritis; anterior uveitis; interstitial, sclerosing, postoperative or acne rosacea keratitis; chemical and thermal burns of the cornea.

**Application:** Apply 1 or 2 drops in the affected eye every 3 or 4 hours, depending upon the severity of the condition. In acute conditions, the drops may be used at more frequent intervals, if required.

**Caution:** Not recommended for herpes corneae (dendritic corneal ulcers) or conditions involving the posterior segment of the eye.

Available in bottles of 5 cc. with sterile dropper.

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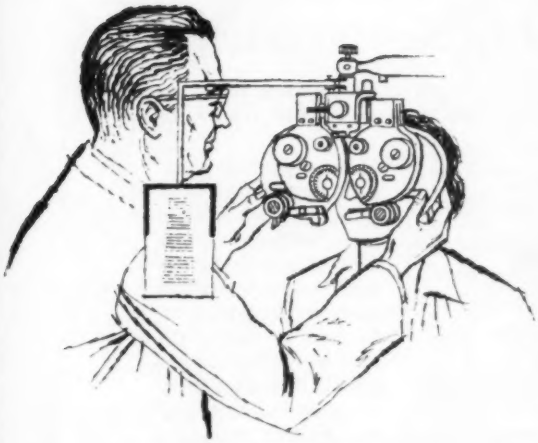

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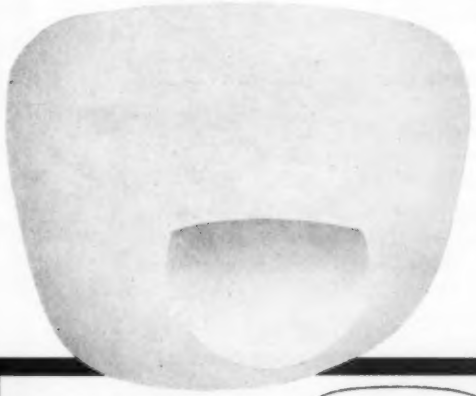

VISION-EASE

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These fine curved-tops are available as regular stock items in most-wanted base curves, adds and tints. For non-standard availabilities, check your laboratory or nearest Vision-Ease Stock Office.

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7 x 24 TRIFOCAL

VISION-EASE C-20
20mm curved-top

VISION-EASE C-22
22mm curved-top

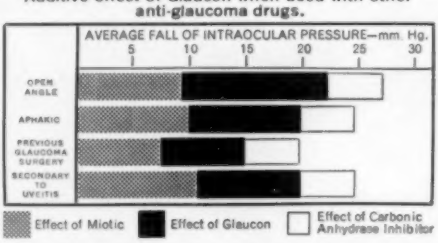
*The OMA/BVI educational program to make the nation aware of the continuing need for proper eye care furthers your efforts in behalf of better vision. The Vision-Ease Corporation is proud of its part in supporting this fine program.*

*In managing open-angle glaucoma...*

"Best results obtained by combined therapy [Glaucon*] with miotics and/or carbonic anhydrase inhibitors"[1]

Glaucon, levo-epinephrine 2% as the hydrochloride, alone has been shown[2] to lower intraocular pressure to a significant degree in open-angle glaucoma.

Additive effect of Glaucon when used with other anti-glaucoma drugs.




However, newer studies conclude: Our most gratifying results have been obtained with Glaucon combined with miotics and/or carbonic anhydrase inhibitors in cases difficult to control or not controlled at all by conventional therapy.[1]

"In our experience most open-angle glaucomas benefit from the combined use of a miotic and Glaucon."[3]

**As adjunctive therapy Glaucon—**

- permits better control of open-angle glaucoma than can be obtained with the miotic alone (often below 20 mg. Hg.)
- reduces the frequency of miotic instillation
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Glaucon is a stable, non-irritating ophthalmic solution which has high patient acceptance. You will find Glaucon a valuable addition to your glaucoma regimens. Glaucon is supplied in sterile 10 ml. bottles with sterile dropper assembly.

1. Garner, L. L., et al; Scientific Exhibit A.A.O.O., Chicago, Oct. 1960
2. Garner, L. L.; Johnson, W. W.; Ballintine, E. J.; Carroll, M. E.; "Effect of 2% Levo-Rotary Epinephrine on the Intraocular Pressures of the Glaucomatous Eye"; A.M.A. Arch. Ophth. 62:230; Aug. 1959
3. Guide to the Medical Management of Open-Angle Glaucoma, 1961, L. L. Garner, M.D., Dir. Glaucoma Consultation and Referral Center, Marquette University School of Medicine.
4. Personal Communication.

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Tama manufactures only quality solutions and sells them only through practitioners. This gives you an opportunity to recommend and sell a product you know is good to your patients, and you reap the benefits of its repeat business.

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A sterile, non-irritating solution that coats the entire lens surface uniformly for greater wearing comfort. Integrated solution cleans and wets.

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ABSTRACTS

Anatomy, embryology, and comparative ophthalmology; General pathology, bacteriology, immunology; Vegetative physiology, biochemistry, pharmacology, toxicology; Physiologic optics, refraction, color vision; Diagnosis and therapy; Ocular motility; Conjunctiva, cornea, sclera; Uvea, sympathetic disease, aqueous; Glaucoma and ocular tension; Crystalline lens; Retina and vitreous; Optic nerve and chiasm; Neuro-ophthalmology; Eyeball, orbit, sinuses; Eyelids, lacrimal apparatus; Tumors; Injuries; Systemic disease and parasites; Congenital deformities, heredity; Hygiene, sociology, education, and history ..... 289

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1. Gordon, D. M.: **Am. J. Ophth.** 47:536, April, 1959.

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# THE TREATMENT OF POSTTHYROTOXIC EXOPHTHALMOS*

## THE SUGGESTED USE OF DEXTRO-THYROXINE

## THE XIV ANNUAL MARK J. SCHOENBERG LECTURE

DERRICK VAIL, M.D.
*Chicago, Illinois*

The Mark J. Schoenberg Lecture is correctly conceded to be one of the major lectures in ophthalmology in this country. The eminent names of those who have preceded me as the annual lecturer and the high scientific quality of their presentations before the societies, which he helped to found, has endowed this event with growing significance in the minds of all of us. I am certain that each of the speakers has felt as I do, that it is a great honor indeed to have been chosen. Each has been eager to pay tribute to the memory of one of our great ophthalmologists, Mark Schoenberg.

Mark Schoenberg was a pioneer, a leader and founder. His interest in the problem of glaucoma must have come early in his career, as shown by his writings, and it is for this leadership that he is chiefly noted. Among other things he was the first to develop, in the Knapp Memorial Eye Hospital in 1935, a clinic devoted exclusively to a study of the glaucoma patient. This idea has spread throughout the world.

He was the first, I believe, to suggest what has since become known as "tonography" (1913). So far as I know he has received little acknowledgment or credit for this conception. This may well become in time his major contribution to the solution of the problem of the early diagnosis and progression of glaucoma simplex.

The term "thyrotropic exophthalmos" at once creates the distressing mental picture of what we are talking about. I chose it with some deliberations because I fear—in the current surge of enthusiastic opinion that it is but a continuous though rare (for example, 10 percent of Schultz's cases) part of the whole picture of Graves' disease—that we are in some danger of neglecting the role of the anterior pituitary gland in the pathogenesis of this form of exophthalmos by its formation of an exophthalmos-producing factor. The classic differential diagnosis of Mulvany cannot and should not be entirely discarded as yet, in my opinion. There are parts of it that are still sound. However, it may well be true that this extreme exophthalmos is but a part of the cycle of Graves' disease. There is impressive and growing evidence that this is so.

The confusion in terminology reflects the confusion in the understanding of Graves' disease. The pathogenesis, or the trigger mechanism of thyrotropic, thyrotrophic, paradoxic, malignant, ophthalmoplegic, ophthalmopathic, hyperophthalmopathic, pituitary-diencephalic, endocrine, progressive exophthalmos—all of these terms are found in the literature—is moot. I can add here another term if you agree, and call this condition, à la Hollywood, "super-colossal exophthalmos."

* From the Departments of Medicine and Ophthalmology, Northwestern University Medical School. Read before a joint meeting of the New York Society for Clinical Ophthalmology and the National Society for the Prevention of Blindness, New York, December 5, 1960.

Fig. 1 (Vail). A patient with postthyrotoxic exophthalmos.

As usual, when one is in trouble, he turns to Duke-Elder. In his superb discussion of the exophthalmos of Graves' disease, he says, "The whole problem is one of extreme complexity," truly a classic British understatement. To be complexed is to be confused. As a much lesser mortal on a much lower plane, therefore, I can plead to a state of complete confusion. However, in the company of Duke-Elder I am on a very high level of confusion.

The proptosis and ophthalmoplegia under discussion, is full of paradoxes. To name a few.

1. Thyrotoxic goiter may produce simple exophthalmos and a number of well-known ocular signs, all eponymic which in itself is a confession of weakness. Robert M. Day in a recent article lists 19 of these signs. Incidentally how many of these can you describe offhand?

2. When the patient is made euthyroid, the lid signs more or less continue indefinitely or may disappear but the exophthalmos in 50 percent of cases (Schultz, et al.) becomes worse and sometimes indeed colossal.

3. ACTH and the steroids make the proptosis worse.

4. Or they may make it better.

5. Surgical decompression may make it better, or worse, or unchanged.

6. Remissions of the ocular signs may occur if the thyrotoxic state is untreated, sometimes in spite of some forms of treatment.

7. The thyrotoxic state can be worsened yet the ocular signs improve.

8. Extreme proptosis may occur without thyrotoxicosis, although I doubt this.

There are other paradoxes that will occur to you, and all of this is quite discouraging.

When the excellent paper of George Smelser on "A comparative study of experimental and clinical exophthalmos" appeared in 1937, the pathogenesis seemed markedly to be simplified, particularly when subsequent workers confirmed in most respects his findings. You will recall that he demonstrated, most convincingly, that thyrotropic exophthalmos, in every way similar to that

Fig. 2 (Vail). Note the pituitary facies, body build and "spade" fingers.

found in the human, could be produced in the thyroidectomized guinea pig by the daily subcutaneous injection of a dissolved precipitate of acetone-dried beef anterior pituitaries. This nontoxic preparation contained "a great deal of gonadotropic, thyrotropic, adrenotropic and growth hormone activity." As the saying is, we thought we had it made.

Shortly after hearing Smelser's paper I saw this patient (fig. 1). He was 44 years of age. Six weeks or so before he had developed thyrotoxicosis with moderate exophthalmos. He underwent a subtotal thyroidectomy. During the subsequent two weeks he developed a fulminating exophthalmos. Besides his ocular findings, I was deeply impressed with his pituitary facies, as you see in Figure 2. Bilateral tarsorrhaphy was performed. Two days later the sutures ripped out. X-ray treatment to the pituitary gland was suggested, but the patient refused and returned to his surgeon, who performed a bilateral Naffziger decompression operation. His recovery was a violent one, during the course of which he developed a corneal ulcer of the right eye with loss of vision (fig. 3).

Fig. 3 (Vail). Appearance of patient after recovery. Note the blind right eye.

Fig. 4 (Vail). Another patient with "burned-out" thyrotoxicosis. Note the unilateral proptosed right eye and pituitary facies.

I thought at first that the acromegalic facies of the patient was confirmatory evidence of the influence of the secretion of the pituitary going wild after thyroidectomy. I later uncovered a similar though much more mild case showing acromegalic facies (fig. 4). Since then all other cases of the disease under discussion that I have seen have not shown any evidence of acromegaly. So much for a beautiful initial promise.

Stallard succeeded in producing exophthalmos in a myxedematous patient by means of a thyrotropic extract in 1936. However, as time went on the crude thyrotrophic extract of those days became purified and now there

is considerable question as to whether or not an exophthalmic-producing agent is present in this pure extract. There is increasing evidence to the contrary. But the question of what impurity of the original extract is responsible for experimentally produced exophthalmos in the guinea pig is still under strenuous investigation.

Dobyns (1945) was able to produce exophthalmos in animals with Antuitrin T., a commercial product; however the purified thyrotropic extract produced epithelial hyperplasia in the thyroid, but not exophthalmos. He separated the gross thyrotrophic extract into three fractions (1) one which raised the B.M.R. without producing epithelial hyperplasia in the thyroid or exophthalmos; (2) epithelial hyperplasia but no exophthalmos and (3) only exophthalmos. "It is only," says Dr. Raymond Greene (1955) of London "to the second principle that we should really give the name of thyrotrophin, and it does not cause exophthalmos when given alone. Impure extracts produce all three effects."

Dobyns (1953, 1954) succeeded in separating an exophthalmos-producing substance (EPS) and a thyroid-stimulating hormone (TSH) and the fun was on, leading to the present-day battle of the fishes. You will recall that the EPS injected by Dobyns and Wilson under proper conditions, into the common Atlantic minnow, Fundulus heteroclitus Linn, produced a measurable exophthalmos. Then using the minnow as test animals, these investigators demonstrated EPS in the serum of patients having explosive exophthalmos (a new term to add to the list). Sometimes the exophthalmos in the fish was very obvious, in other instances it could only be demonstrated by measurements.

In 1956, Canadell and J. Barraquer found that the goldfish (Carassius auratus var. japonicus, subvar. bicaudatus) responds to the administration of thyrotropic hormone with exophthalmos. This could be increased with simultaneous injections of corticotrophin, indicating that corticotrophin and the activity of the adrenal cortex have a potentiating effect.

Robert M. Day succeeded in producing exophthalmos in the Atlantic minnow 19 times out of 24 (79 percent), by the injection of three different Armour thyroid-stimulating hormone preparations. However, no significant exophthalmos could be produced in the goldfish (he does not say that his goldfish were var. japonicus, sub. var. bicaudatus) with extracts of the anterior pituitary gland, or in either fish with the serum from patients with progressive exophthalmos.

Schultz and his coworkers, have recently found that the "Atlantic minnow consistently developed exophthalmos in response to injections of a commercially prepared pituitary extract. The injections, however, of test sera obtained from 21 patients with all phases of the endocrine eye lesion into these fish failed to produce a detectable exophthalmos."

These experiments show that there is such a thing as EPS formed in the extract of anterior pituitary tissue. But what it is and what, if any, effect EPS has in the human is still to be shown. If such an anterior pituitary hormone is responsible how is exophthalmos produced? This is the prize question.

Greene (1955) gave evidence that the mucopolysaccharides are extremely hygroscopic and play a major role in the maintenance of the water content of the tissues. (See also Wegelius, et al.) George Smelser and Victoria Ozanics found that the orbital connective tissue of exophthalmic guinea pigs was significantly more hydrophilic than that of the normal nonexophthalmic thyroidectomized animals. The degree of hydrophilia of orbital tissue was greatest in the most severe cases of exophthalmos. Since the mucopolysaccharides in the orbital connective tissue are increased in endocrine exophthalmos, it is logical to assume that these substances, adversely affected in an as yet unknown manner, account for the swelling and edema, leading to later fibroplastic

changes, that are the essential pathologic components in endocrine exophthalmos. I am sure that Smelser and his group are once more on the right track. If so, it is possible that some effective form of treatment directed to reduction of mucopolysaccharides in the orbit may in the future be evolved.

In an abstract in the *Proceedings* of the Central Society for Clinical Research (33: 11 1960) W. H. Beiewaltes and his associates discuss the extraocular muscle, skeletal muscle and thyroid gland mucopolysaccharide response to TSH. They performed their controlled experiments on dogs and showed that TSH is associated with widespread alteration in tissues coincident with the accumulation of acid mucopolysaccharide. They concluded that this effect of TSH on muscle appears to be direct and not mediated through the thyroid gland. This work is thus further evidence of the villainous role played by the acid mucopolysaccharides, and the trigger mechanism of TSH.

Before proceeding with a discussion of the present-day treatment of this condition, which after all is the subject of this lecture, I should like to give some brief gleanings from the literature on Graves' disease. Although it was originally thought that thyrotoxicosis was best treated with radioactive iodine in patients over the age of 40 years, there is now almost 30 years of experience in the use of radio-iodine without indication that there are late carcinogenic effects. The use of $I^{131}$ in any amount—diagnostic or therapeutic—is to be avoided in pregnancy. Most clinicians consider that thyroidectomy is still the preferred form of treatment of thyrotoxicosis in the adolescent or in the presence of thyrotoxicosis with a solitary adenoma.

Moderate to severe changes in the orbit are probably produced by too rapid control of thyrotoxicosis (Sloan).

Gross digital clubbing is sometimes found associated with endocrine exophthalmos (Freeman).

Pretibial myxedema, first described in 1895 by Watson-William, is also an associated finding at times. Disturbance of mucopolysaccharides in the pretibial tissue is present. The most violent forms of exophthalmos are often found in the presence of pretibial myxedema. When the latter is worse so is the exophthalmos, and vice versa.

Infantile thyrotoxic and thyrotropic exophthalmos, subsequent to pregnancy of a thyrotoxic mother, has been reported several times (Hoffman and Lundquist).

The ocular muscles most often affected are the elevators of the eye (14 percent—Schultz, et al.).

Electromyographic studies by Schultz show a myopathic reaction, except in the occasional rare case of endocrine exophthalmos without hyperthyroidism. Here the electromyograph suggested denervation which Schultz thought was the result of compression or ischemia of the nerve trunks secondary to intense orbital edema. Breinin found that neurogenic palsy patterns appeared in most of the cases of endocrine exophthalmos that he had studied.

Optic nerve disturbances seldom occur but, when they do, the vision and fields of vision are affected. If the optic nerve is pale, prognosis for the return of vision should be guarded (Igersheimer). Such patients have been subjected to brain surgery due to a faulty diagnosis based on these findings.

Ophthalmoplegias may improve or disappear entirely in the course of time when the thyrotoxicosis is controlled (about 50 percent, Schultz). Ocular pain, tearing, burning, diplopia and attacks of blurred vision are early symptoms. Of these tearing and burning are most frequent. A patient who shows an unexpected vertical muscle imbalance may later on show endocrine exophthalmos (Rae).

There is a high familial incidence in the disease.

"Patients without thyrotoxicosis who present a clinical picture similar to the endocrine eye lesion frequently have predominantly unilateral disease and a high incidence of ophthalmoplegia" (Schultz). (I believe that these patients have had a mild and

undiagnosed thyrotoxicosis in the past that has burned itself out.) These patients according to Schultz, will frequently show a positive Werner test.

There is a pschyogenic factor acting as a trigger mechanism in some of the cases (Mann).

Rarely does the degree of exophthalmos recede after the patient is made euthyroid. In many cases the improvement is only apparent.

The causes of the lid retraction and lid lag are unknown. They improve in many cases after the patient reaches an euthyroid state and this may make the proptosis appear to be less than it really is. John McLean and E. W. D. Norton, in discussing unilateral lid retraction without exophthalmos, showed that electromyographic studies on the affected levator in four of their patients had no increased activity, as compared with the levator on the uninvolved side. This indicated that lid retraction is secondary to changes in the levator surface itself.

Other extrathyroidal manifestations of Graves' disease are: (a) generalized muscular weakness (fatty infiltration and infiltration with round cells); (b) the liver may show loss of glycogen, fatty infiltration, focal central necrosis and some degree of fibrosis; (c) enlargement of the lymph nodes and thymus, which may be related to the association with myasthenia gravis that is occasionally encountered; (d) vitiligo may precede thyrotoxicosis.

Rheumatoid arthritis is frequently exacerbated by removal of the thyroid.

Glaucoma has been reported as accompanying endocrine exophthalmos. This may not be a true glaucoma but could be due to increased orbital pressure only and thus give false tonometer readings.

The following are some case reports of patients with endocrine exophthalmos who are currently being studied by the joint activity of Ralph E. Dolkart, Joseph H. Skom, Robert Dowben of the Department of Medicine, and David Shoch and myself of the Department of Ophthalmology, Northwestern University Medical School. Taken together they reveal most of the findings already outlined.

## Case reports

### Case 1

Mrs. F. P. O., aged 54 years. The first symptom appeared on November 1, 1955, at which time there was a transient diplopia. Three weeks later there was a second episode. Following seven such experiences she was hospitalized for study at another institution and discharged with a diagnosis of "sinusitis." In late December, 1955, she noted the development of a head tremor and proptosis of the left eye. In April, 1956, she was seen in a second institution where a diagnosis of hyperthyroidism was made and she was started on iodine.

She was first examined by me on May 7, 1956, two weeks after the occurrence of exophthalmos involving the right eye, congestion thereof, and difficulty in downward gaze. There was bilateral periorbital edema, greater on the right than on the left, bilateral retraction of the upper lids and bilateral proptosis (23/23/100*). The right eye could not look down, the left eye could not look up. The B.M.R. determination at this time was +52 percent.

She was then placed under treatment of her local physician who administered $I^{131}$ and subsequently started her on Lugol's solution, tri-iodothyronine, and small oral doses of steroids. The eye manifestations failed to improve and she was transferred to our group for further care.

At this time she was found to be euthyroid on her current medication. A right-sided tarsorrhaphy was done on April 18, 1957. Therapy was then directed as follows: (1) Maintenance of the euthyroid state which she had then achieved; (2) efforts to suppress TSH production by (a) x-irradiation of the pituitary and (b) the initial use of ACTH which was later replaced by oral prednisolone; and (c) administration of d-thyroxine and the gradual withdrawal of the prednisolone, begun in December, 1959. On her last visit in December, 1960, the exophthalmos measured 17/17/100 but the ophthalmoplegia persisted.

### Case 2

Mrs. L. G., aged 45 years. In November, 1948, a diagnosis of hypothyroidism was established and therapy with desiccated thyroid in doses of 90 to 120 mg. daily was begun. There was amelioration of her symptoms and she was observed semiannually. Contrary to instructions, she failed to report for supervision, although she continued to take the thyroid. She was under considerable emo-

* These numbers means that the right eye measured 23 mm., the left eye 23 mm., with exophthalmometer base 100.

tional tension with a tumultuous home situation.

In late 1958, after an absence of two years, she returned complaining of nervousness and increasing prominence of her eyes. Exophthalmos and lid-lag were present. A diagnosis of hyperthyroidism was made and treatment with $I^{131}$ established.

Although the nervousness and cardiovascular symptoms improved, the eye symptoms became worse (fig. 5). It was observed at this time that there was pretibial myxedema (fig. 6) and that as this became worse so did the eye findings. Because of the rapid increase in eye signs, a tarsorrhaphy was done in another hospital. This tore apart in a few days.

In October, 1955, a bilateral Naffziger procedure was done. The exophthalmometer readings were 30/31/100. Postsurgically there was no improvement, in fact the situation worsened, with palpebral as well as bulbar conjunctival edema so massive as to obscure vision completely.

Because of the role of ACTH in suppressing the TSH production, as well as its ability to alter exudative processes, ACTH was begun, with rapid improvement in the situation. This was continued for a period of three years in gradually decreasing doses, then supplanted with oral prednisilone which, in turn, was gradually withdrawn and d-thyroxine was started in December, 1959. Thyroid extract was likewise administered to attain and maintain a euthyroid state. X-irradiation to the pituitary was given some six months postsurgically. As in Case 1, no immediate effects was discernible.

Fig. 5 (Vail). *Case 2.* Severe postthyrotoxic exophthalmos.

Fig. 6 (Vail). *Case 2.* Pretibial myxedema, right.

At present she is still receiving thyroid extract and d-thyroxine. The vision is normal and there is no muscle imbalance or diplopia. The current exophthalmometer readings are 30/30/100.

CASE 3

J. M., aged 60 years, was seen in another hospital in September, 1957, with bilateral proptosis and a partial loss of vision extending over a six-month period. Lid-lag was present. Vision in the right eye was 20/70, left eye 20/40, and there was bilateral constriction of the field of vision. The disc margins were pale and blurred bilaterally. Exophthalmometer reading was 20/20/105.

A neurosurgeon at this time advised a craniotomy after making a diagnosis of a brain tumor. The patient wisely refused and sought additional consultations from a series of other physicians. Because of increasing proptosis a bilateral Naffziger procedure was finally done. This was followed by no improvement and he was referred to one of us (R. E. D.) for further opinion.

It was found that he was euthyroid at this time but, on reviewing his history, it was found that, following a perineal prostatectomy for obstructive symptoms in 1956, his hospitalization was protracted because of an unexplained 40-pound weight loss and tremor. It was believed, therefore, that we were dealing with a postthyrotoxic exophthalmos, and the original episode had gone unrecognized.

With small amounts of desiccated thyroid, and oral prednisilone, there was rapid and marked improvement in vision. Since December, 1959, he had been receiving d-thyroxine only and the vision in each eye is now normal. The exophthalmos has remained unchanged.

These three cases illustrate severe exophthalmos subsequent to the occurrence of

hyperthyroid episodes, which were treated by a multiplicity of procedures. It would certainly appear that the orbital decompression had no value in arresting the ocular difficulties. No clear case can be made for the role of any of the therapeutic methods other than to say that suppression of TSH production was attempted by all known methods and which one was responsible for the improvement cannot be ascertained.

The next three cases illustrate a more associated and clear implication of therapeutic response.

CASE 4

Mrs. E. B., aged 31 years, was seen on August 5, 1959, and thyrotoxicosis was diagnosed. On August 12, 1959, $I^{131}$ given. Vision was 20/20 in each eye. Exophthalmometer reading was 18/21/95. There was retraction of the upper lids and no muscle imbalance. On December 14, 1959, she was euthyroid. On January 25, 1960, she was placed on d-thyroxine. By May 9, 1960, the exophthalmometer reading was 19.5/21/95. The patient was greatly improved generally. There was no lid edema and the lid retraction and proptosis were unchanged.

CASE 5

Mrs. S. K., aged 47 years, was first seen on August 28, 1959. For the preceding five weeks she had noticed that her lids were puffy, eyes watery and there was occasional diplopia for distance. A physical examination one year previously was reported as negative. Vision was 20/20 in each eye, with five prism diopters of exophoria for near. There was paralysis of the left superior rectus and slight proptosis. The exophthalmometer reading was 22/21/100. Lid-lag was especially noticeable on the right side. She was hospitalized, a diagnosis of hyperthyroidism was established, and she was treated with $I^{131}$. She subsequently became hypothyroid and was then given 30 mg. of thyroid extract and d-thyroxine, (2.0 mg. daily). Exophthalmometer reading was 22/22/100. There was diplopia on upward gaze.

By May 3, 1960, she was euthyroid on her thyroid supplement. The vision was normal in each eye. No diplopia was noticed but tests showed paralysis of the left superior rectus muscle. There was no change in the degree of proptosis. The patient feels well. She is now taking 8.0 mg. of d-thyroxine daily.

CASE 6

Mrs. S., a 43-year-old divorced mother of one child, was first seen in July, 1960, 12 years after a subtotal thyroidectomy for thyrotoxicosis. The exophthalmos has been unchanged for several years and measured 27/27.5/96. $I^{131}$-uptake studies were within normal limits and BMR determination was —9.0 percent, indicative of a euthyroid state. D-thyrosine was begun at a level of 4.0 mg. per day. Exophthalmometer readings have shown a regression of 1.0 mm. There has been no alteration of the basal metabolic rate determination since the administration of d-thyroxine.

The treatment of thyrotropic exophthalmos is here divided into (a) the surgical and (b) medical treatment.

SURGICAL TREATMENT

All of us agree that the corneas in these cases must be protected as early and as efficiently as possible. More eyes have been lost from exposure keratitis than from optic-nerve atrophy.

1. *Tarsorrhaphy*—in simple exophthalmos the operation is easy, efficient and extremely valuable. In malignant (explosive) cases this is difficult and the sutures tear out of the boggy lids early and easily. Thus it seems that every effort should be made to postpone, if possible, this operation until the lids are less swollen and fragile. Moist chamber dressings are advisable. Frequent compresses of a magnesium sulfate and sodium chloride solution are valuable. Tarsorrhaphy at the earliest favorable opportunity should be done.

2. *Conjunctival apron flap from above.* This can easily be performed and, if desired, can be made more or less permanent by cauterization of the sclera below in order to get firm fibrous adhesions.

3. *Canthotomy and removal of some orbital fat* (Foster Moore) should be thought of, but probably not performed. Canthotomy and tarsorrhaphy without attempting opening of the orbital septum are probably better.

4. *Tenotomy of all the ocular muscles* and rotation of the eyeball should be considered in desperate cases so that only sclera is exposed.

5. *Recession of the levator muscle.* This operation is valuable when the exophthalmos becomes stabilized, in order to improve the appearance of the patient (staring) and to add protection to the proptosed eyeball. Al-

though I have never heard of it being done during the acute fulminating proptosis, it is something to be thought of: (a) it might make tarsorrhaphy easier and hold better; (b) it might protect the cornea, too. In this event the thought occurs that a tenotomy of the levator, tagging it with a metal clip, as suggested by McLean, might work. Later on the tagged levator could be replaced in the most favorable position in the individual case.

6. *Decompression operations.* (Naffziger, or Krönlein, Shugrue, Berke, Guyton.) These procedures are only efficacious apparently early in the disease. Later the hyalinized muscles and fibrosed orbital tissues will not herniate. I have never personally seen any real benefit from a decompression operation. The immediate postoperative reaction is always a violently edematous one. There is some mortality due directly to the surgery.

7. *Surgery of the pituitary.* This is a very formidable procedure indeed. E. P. McCullagh, et al., of the Cleveland Clinic, reported nine patients out of 39 who had hypophyseal surgery. These authors sectioned the pituitary stalk or cauterized the anterior lobe of the pituitary or both. In all cases the exophthalmos improved, in some disappearing entirely. Albeaux-Fernet, et al., performed a hypophysectomy on a woman patient, aged 56 years. There was progressive exophthalmos for two months postoperatively which improved at the end of four months. Histologic studies, among other things, showed many granulations rich in polysaccharides. To me this is the significant finding.

8. *Surgery for the relief of ophthalmoplegia.* So far, I have not operated on the ocular muscles in these cases, nor can I discover very much about it in the literature. But it would seem desirable, when the patient is euthyroid and the ocular muscle imbalance is stabilized, that ocular muscle surgery should be performed. Should one recess the fibrosed muscles or resect or advance the normal-acting opponents? It would seem logical to recess the affected muscles (Dunnington).

## Medical treatment

### 1. Thyrotoxic stage

It seems generally agreed that inactivation of the thyroid can be accurately accomplished in most instances with therapeutic doses of radioactive iodine. In the presence of intense thyrotoxic symptoms, even the four- to six-week period of awaiting attenuation of thyroid activity following $I^{131}$ administration, can be shortened by the temporary administration of iodine, as long as one waits for four to six days after the $I^{131}$ dose. Surgical ablation of the thyroid gland is limited to special situations—adolescence, the solitary toxic nodule and pregnancy. In the latter situation, the thiourea derivates may be employed, care being taken to fulfill the iodine needs for fetal thyroid development beginning in the fourth month of gestation.

### 2. Posttthyrotoxic stage

a. *Hyaluronidase.* In 1950, Lebensohn suggested the intraorbital injection of this enzyme in such cases. It has been used both with some success and some failures. Laurent and Scopes' use of this substance in one patient was most effective. Hyaluronidase should be borne in mind and more widely used, in my opinion.

In the presence of exophthalmos, efforts have been directed toward reduction of the pituitary production of the TSH.

b. *X-irradiation* to the pituitary has been employed by several groups. The effects of irradiation are slow at best and when evaluated along with the other multiple procedures done at the same time, it is almost impossible to assess the efficacy of such treatment. This is true of the cases reported in the literature, as well as our own cited here. There now seems to be better ways to suppress TSH production.

c. *The adrenocorticotropic hormone and/or the corticosteroid* have at least a theoretic role in suppressing TSH production. Any excess of steroid of exogenous origin has been shown to suppress all modalities of pituitary production of all tropic hormones as well as TSH. Whether the role of the steroids in interferring with the inflammatory and exudative response of tissues plays any additional role would be a moot question. The group of patients reported by the British Medical Research Council suggested that patients whose proptosis was unaccompanied by edema and chemosis showed the least response to treatment.

d. *Efforts to attain and maintain a euthyroid state.* Over and above the attainment of a normal physiologic state, the suppression of excess production of TSH seems essential. Whether dessicated thyroid extract, thyroxine or tri-iodothyroxine is used seems immaterial. The preparation should be selected on the basis of that which is most familiar to the clinician, is most available and with the highest degree of biologic standardization.

e. *Dextro-rotary thyroxine.* As of this writing, there would appear to be an adjunctive form of treatment. Our data are insufficient to draw any but superficial conclusions and are premature. In 1958, Greene and Farran reported on the physiologic activity of d-thyroxine. Other investigators as well, notably Benua, et al., have appraised its properties by a variety of methods. Only one-tenth the metabolic effect is produced by the synthetic d-thyroxine as compared with the l-thyroxine isomer normally occurring in the human thyroid gland.

Dosages of d-thyroxine, therefore, too small to affect metabolic activity are capable, even in cases of thyrotoxicosis, of suppressing the uptake of radio-iodine and, by inference, therefore the production of TSH. Greene and Farran were able to induce a remission of thyrotoxicosis in two of six patients but reported no improvement in the exophthalmos. These workers used considerably smaller dosages, however, than did our group.

## Conclusions

On conclusion of this study, I find that I am still confused but on a lower level than at the beginning. In fact there is beginning to be some light ahead. I believe therefore that:

1. Thyrotropic exophthalmos is still thyrotropic.

2. It only occurs when the thyrotoxic state of Graves' disease is abruptly terminated by either medical treatment or by thyroidectomy. The more abrupt this is, the more severe is the thyrotropic exophthalmos. On the other hand, cases of milder exophthalmos, frequently unilateral, or at least greater in one orbit than the other, with or without ophthalmoplegia, are occasionally seen. These patients are euthyroid. But lid-lag, pathognomonic of Graves' disease, is almost always present in my experience. There may be, but usually is not, an old history of mild thyrotoxicosis. The case is therefore one of a spontaneous burning out or involution, without medication, of Graves' disease. This spontaneous cure must always be a slow one. Therefore, the thyrotropic exophthalmos is mild and hyalinization and fibrosis of the extraocular muscles do not take place.

3. Medical treatment with $I^{131}$, or subtotal thyroidectomy of those patients not thought appropriate for radio-iodine, should be the methods employed. Following this:

4. Immediate treatment with d-thyroxine should be begun and continued as long as is necessary. Appropriate amounts of thyroid extract should be added, in order to create a state of euthyroidism.

5. Early use of the steroids in order to reduce orbital edema should seriously be considered.

6. Finally, I boldly suggest a new name for this disorder: *Postthyrotoxic exophthalmos.*

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# EFFECTS OF PHOTOCOAGULATION OF CILIARY BODY UPON OCULAR TENSION*

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## 1. Method, instrumentation and scope

Light that traverses the transparent media of the eye becomes converted into heat on striking a pigmented tissue by which it is absorbed. This principle forms the basis of the Meyer-Schwickerath technique of photocoagulation. The apparatus has an intense luminous source, produced by a bulb filled with Xenon under high pressure. Filters eliminate most of the infrared and ultraviolet and thus limit the radiation to wavelengths in the 350-1000 millimicron range. An optical system focuses these rays on the retina and choroid (figs. 1 and 2). Meyer-Schwickerath[3] has effectively treated with photocoagulation diverse affections of these tissues. An added accessory (fig. 3) empowers the apparatus to concentrate rays on the anterior segment and has extended thereby the indications for this technique. Photocoagulation of the iris, for instance, is the method of choice for producing a useful pupil in an aphakic eye with an updrawn iris.[3, 4, 6]

The aim of this study is to investigate the effects on the ocular tension by the photocoagulation of the ciliary body. Transillumination demonstrates that the bulbar conjunctiva and sclera are translucent and that the ciliary body is relatively opaque to light. On the other hand, some preliminary trials made on a rabbits' eye have shown that chorioretinitis occurs through photocoagulation just as easily externally through the sclera as through the cornea, lens and vitreous body.

Photocoagulation can therefore electively heat a ciliary body without causing any injury to the bulbar conjunctiva and sclera.

The experience gathered from diathermy shows that the heating of the ciliary body causes ocular hypotension. This hypotension is not due to an increase of the facility of aqueous outflow but to a lowering of the formation of aqueous. This hypotension can be obtained either through retrociliary diathermy or angiodiathermy of the long posterior ciliary arteries.[5]

These observations suggested that the activity of the ciliary body could be likewise reduced by photocoagulation. This idea was investigated by (a) an anatomico-pathologic study of the lesions induced by photocoagulation of the ciliary body in 10 rabbit eyes and in two human eyes destined for enucleation because of sarcoma of the choroid; (b) an analysis of the changes in ocular tension after photocoagulation of the ciliary body in 15 rabbits and in 22 human eyes affected with advanced primary or secondary glaucoma. Though the method proved successful in reducing ocular tension, it showed no superiority to the various forms of cyclodiathermy currently employed. This analysis is still in the experimental stage.

## 2. Operative technique, evolution and postoperative complications

A. In rabbits the operation and the measurement of ocular tension were performed under general anesthesia with intravenous nembutal (0.5 cc/kg. of 6.0-percent solution). During photocoagulation the cornea was irrigated with ice-cold physiologic saline.

a. *Transconjunctival-transscleral technique.* The image of the electrodes in the photocoagulating lamp was focused on the

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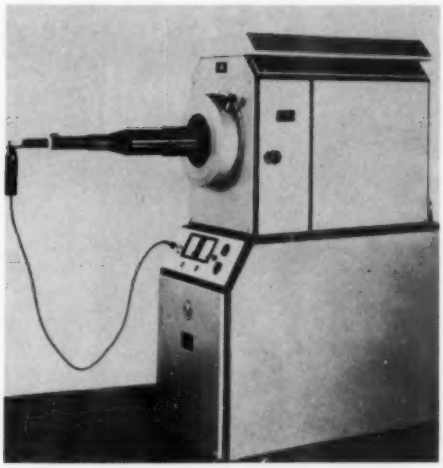

Fig. 1 (Weekers, et al.). The Meyer-Schwickerath apparatus for photocoagulation. (Made by C. Zeiss.)

sclera through the conjunctiva. The modalities employed were: optic diaphragm completely open; beam, six-degree diameter; duration, one second; intensity, 45 to 70 amperes. Photocoagulations were made at the limbus and at some millimeters posterior.

b. *Transscleral technique.* A conjunctival flap in the selected sector was dissected to the limbus and turned down over the cornea. Since blood absorbs light and so reduces the effect of photocoagulation, meticulous hemostasis of the operative field is imperative. The dosage did not exceed 45 amperes; otherwise the procedure was identical with that already described. The conjunctiva was sutured with catgut.

After both techniques, chemosis and subconjunctival hemorrhages appeared in 24 hours. The pupil dilated—a dilatation that

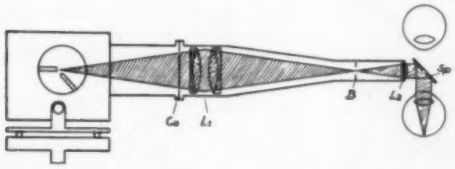

Fig. 2 (Weekers, et al.). Course of rays in photocoagulation of the deep membranes of the eye.

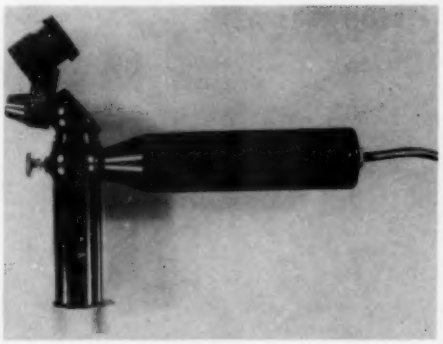

Fig. 3 (Weekers, et al.). Accessory for photocoagulation of the anterior segment.

was asymmetric and irregular when the photocoagulation was confined to but one sector of the ciliary body. The photomotor reactions were sluggish and iridic vessels became more apparent. The cornea near the limbus occasionally showed transient clouding. Hyphema and fibrin in the anterior chamber appeared in three eyes but was completely absorbed in two; the third eye went on to atrophy.

B. IN MAN, a retrobulbar injection of 1.0 cc. of 4.0-percent procaine combined with instillations of a surface anesthetic produced very adequate local anesthesia. During photocoagulation the cornea was irrigated with ice-cold physiologic saline.

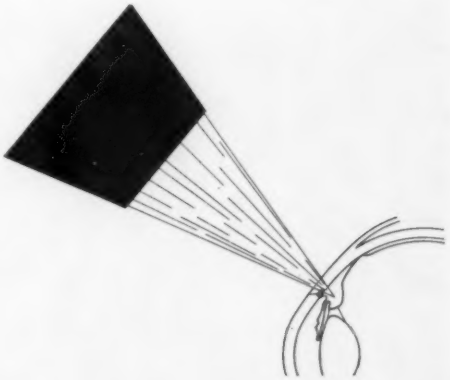

Fig. 4 (Weekers, et al.). Diagram illustrating transscleral photocoagulation of the ciliary body.

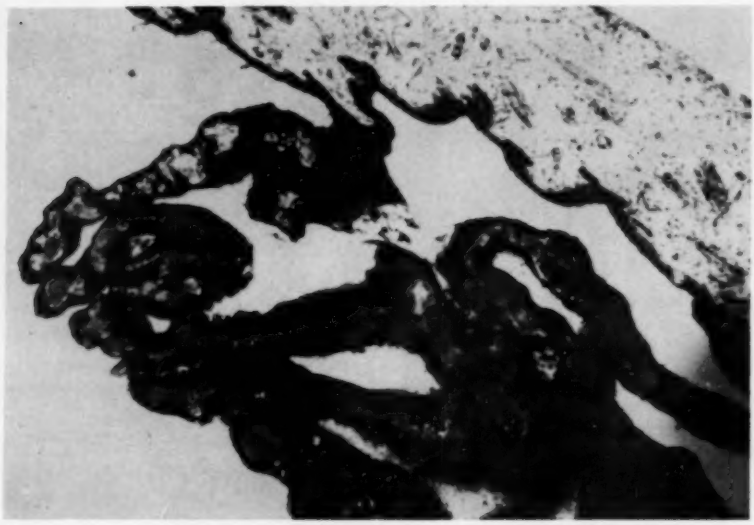

Fig. 5 (Weekers, et al.). *Rabbit 1.* Enucleation seven days after photocoagulation of ciliary body. Note marked thrombotic lesions in ciliary processes. (×80.)

a. *Transconjunctival superficial transscleral technique.* The image of the electrodes was focused on the sclera through the conjunctiva. The modalities employed were: optic diaphragm completely open; beam, six-degree diameter; duration, one second; intensity, 75 amperes. Photocoagulations were made at three to four mm. from the limbus.

b. *Transconjunctival deep transscleral technique.* Here, instead of focusing the image of the lamp electrodes, the luminous points produced by six rays passing through a stop-screen served to guide the placing of the maximum concentration of light at two to three mm. below the scleral surface, that is, within the ciliary body (fig. 4). The same modalities were used as in the previous technique.

c. *Transscleral technique.* A conjunctival flap in the sector chosen was dissected to the

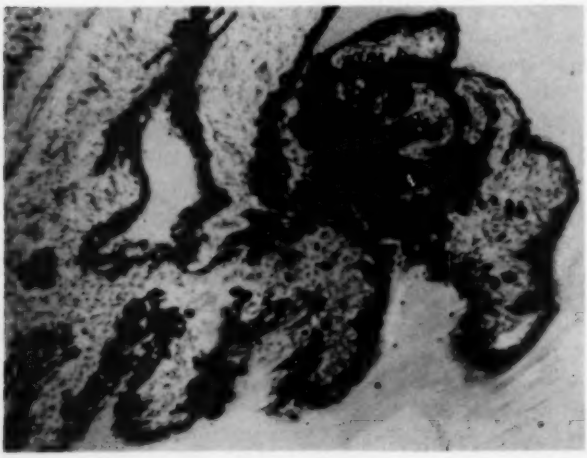

Fig. 6 (Weekers, et al.). *Rabbit 10.* Enucleation two months after photocoagulation of the ciliary body. Note pigmentary reaction and disorganization of both pigmented and nonpigmented epithelium. (×80.)

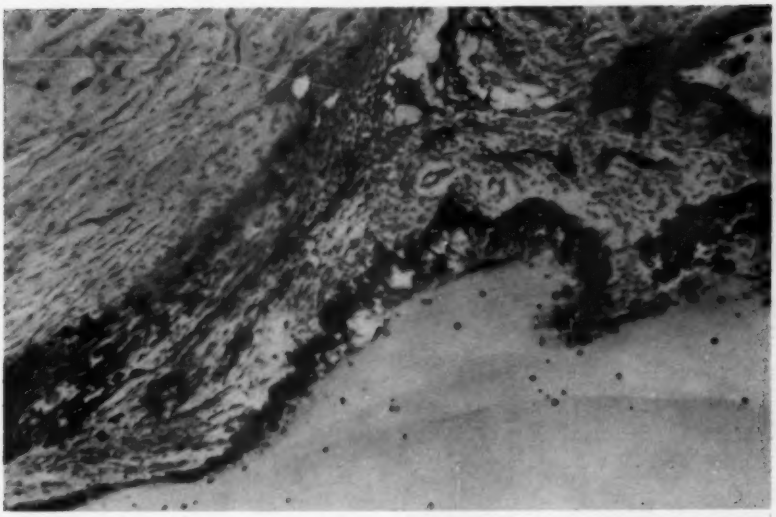

Fig. 7 (Weekers, et al.). *Rabbit 10.* Enucleation two months after photocoagulation of the ciliary body. Characteristic pigment reaction. Nonpigmented epithelium shows vacuoles. (×80.)

limbus for 90 to 180 degrees and folded down over the cornea. After complete hemostasis was obtained, the light was focused directly on the sclera as in the superficial transscleral technique, and the same modalities were used. The conjunctiva was then sutured with catgut.

After the transconjunctival superficial transscleral technique, the conjunctiva displayed for three to four days small ischemic burn-spots surrounded by moderate edema. After the transscleral technique, the immediate reaction was only that incident to conjunctival dissection. The ciliary reaction that came two days later was mild when the photocoagulation was directed to the sclera but very marked when the rays were concentrated within the ciliary body. Transient hyphema and fibrin in the anterior chamber were then occasionally evident.

Fig. 8 (Weekers, et al.). *Rabbit 9.* Enucleation nine weeks after photocoagulation of the ciliary body. Note atrophic ciliary process, cellular rarefaction and absence of vascularization. (×80.)

Fig. 9 (Weekers, et al.). *Human eye.* Enucleated 24 hours after photocoagulation of the ciliary body, showing vitrification of collagen. (×80.)

### 3. Anatomico-pathologic studies

The morphologic picture of the lesion and its extent depended on the intensity of photocoagulation and the lapse of time before enucleation.

A. In rabbit eyes enucleated a few days after photocoagulation, the ciliary processes presented thromboses; the pigmentary epithelium lost its cellular structure; and the nonpigmented epithelium had disappeared (fig. 5). Two months after a mild photocoagulation, the general structure of the ciliary body was modified only slightly but the pigmented and nonpigmented epithelium remained injured. The pigmented epithelium showed the characteristic "cannon-ball" masses of pigment, described by McDonald and Light.[2] In the nonpigmented epithelium most of the cells showed vacuolization (fig. 6).

The ciliary tissue in eyes enucleated two months after a more intense radiation presented very dense collections of pigment, rarefaction and vascularization. The nonpigmented epithelium exhibited no regeneration (fig. 7).

One globe became atrophic two months after photocoagulation. Its ciliary processes were altered or dissipated; the connective tissue was hyalinized; the vessels were attenuated; the pigmentary reactions were as previously described; and the nonpigmented epithelium had disappeared (fig. 8).

B. In the human eye, the thickness of connective tissue traversed by the luminous beam before reaching the pigmented epithelium is much thicker than in the rabbit eye and consequently the luminous intensity at the pigment level is probably less. The

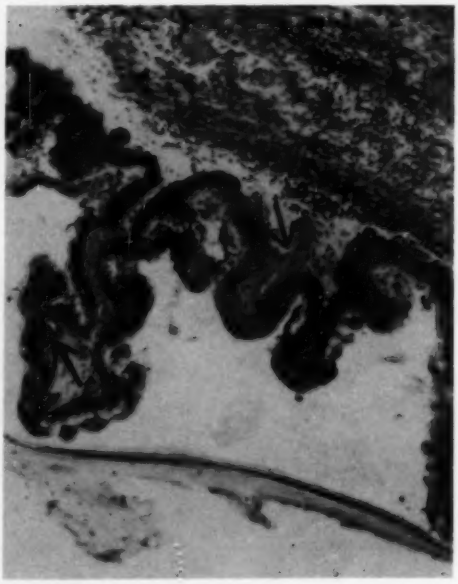

Fig. 10 (Weekers, et al.). *Human eye.* Enucleated 24 hours after photocoagulation of the ciliary body. The arrows indicate disseminated thromboses. (×80.)

TABLE 1

EFFECT OF PHOTOCOAGULATION OF CILIARY BODY ON OCULAR TENSION IN RABBITS

| Rabbits | Ocular Tensions (mm.Hg) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Right Eye No. | Before | Photocoagulation (technique) | After Photocoagulation (wks.) | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 18 | Transconj., 180° temporal | 7 | — | — | — | — | — | — | — | — | — |
| 2 | 15 | Transconj., 90° supéro-temp. | 0 | 8 | — | 19 | — | — | — | — | — | — |
| 2 | 15 | Transconj., 90° supéro-nas. | 6 | 12 | — | 17 | — | — | — | — | — | — |
| 4 | 29 | Transconj., 360° | 8 | 15 | 7 | — | 12 | 16 | 9 | 21 | — | 11 |
| 6 | 21 | Transconj., 360° | 13 | 24 | 24 | 17 | — | — | — | — | — | — |
| 6 | 17 | Transconj., 360° | — | 11 | — | 18 | — | 19 | — | — | — | — |
| 7 | 8 | Transconj., 360° | 11 | 17 | 14 | 17 | — | — | — | — | — | — |
| 7 | 17 | Transconj., 360° | — | 9 | — | 17 | — | 14 | — | 0 | — | — |
| 8 | 11 | Transconj., 360° | 6 | 19 | 10 | — | — | — | — | — | — | — |
| 9 | 20 | Transconj., 360° | 5 | 15 | 10 | 14 | — | 16 | — | 16 | — | 17 |
| 10 | 26 | Transconj., 360° | 6 | 14 | 22 | — | 21 | — | — | — | — | — |
| 11 | 20 | Transscleral., 90° inf.-temp. | 5 | 18 | — | — | 17 | — | — | 17 | — | — |
| 11 | 17 | Transscleral., 90° sup.-temp. | 6 | — | 13 | — | — | 16 | — | — | — | — |
| 12 | 30 | Transscleral., 90° inf.-temp. | — | 8 | — | 28 | — | — | — | — | — | — |
| 13 | 18 | Transscleral., 90° inf.-temp. | 0 | 13 | — | 27 | — | — | — | — | — | — |
| 13 | 27 | Transscleral., 90° sup.-temp. | 7 | — | — | 14 | 18 | — | — | — | — | — |
| 13 | 18 | Transscleral., 90° inf.-nas. | — | 23 | — | — | 20 | — | — | — | — | — |
| 14 | 21 | Transscleral., 90° inf.-temp. | 18 | — | — | 20 | — | — | — | — | — | — |
| 14 | 20 | Transscleral., 90° sup.-temp. | — | — | 20 | 20 | — | — | — | — | — | — |
| 14 | 20 | Transscleral., 90° inf.-nas. | — | 12 | — | — | 20 | — | — | — | — | — |
| 15 | 22 | Transscleral., 90° inf.-temp. | 0 | — | — | 22 | — | — | 15 | — | — | — |
| 15 | 15 | Transconj., 180° supér. | 6 | — | 11 | — | — | 11 | — | — | — | — |
| 16 | 18 | Transscleral., 90° inf.-temp. | 0 | — | — | 26 | — | — | — | — | — | — |
| 16 | 26 | Transscleral., 90° sup.-temp. | — | — | 18 | 21 | — | — | — | — | — | — |
| 16 | 21 | Transscleral., 90° inf.-nas. | — | 17 | — | — | 26 | — | — | — | — | — |

ciliary body in man is also better differentiated. One human eyeball was enucleated for study immediately after photocoagulation; the other, after a span of 24 hours. The lesions observed resembled those described in the rabbit but were more scattered and much milder (figs. 9 and 10).

### 4. Effects on ocular tension

In rabbits, the effect of transscleral photocoagulation on ocular tension is summarized in Table 1. In man, the effect of transscleral photocoagulation on ocular tension in 12 cases of open-angle glaucoma is summarized in Table 2; and the results of the same technique is aphakic glaucoma following a prolonged flat chamber are summarized in Table 3.

## Discussion

Our work demonstrated that photocoagulation of the ciliary body reduced ocular tension in the normal eye of the rabbit and in human eyes affected with primary or secondary glaucoma. The normal formation of aqueous demands an anatomic integrity of the ciliary processes.[1] Our anatomico-pathologic observations show that photocoagulation disturbs the circulation of blood in the ciliary body and produces serious injury to the epithelium. Hence it may be presumed that photocoagulation of the ciliary body, like diathermy thereof, effects a lowering of ocular tension by lessening the production of aqueous. Tables 1, 2 and 3 show that this reduction was transitory. It would seem that spontaneous healing of milder lesions occurred or that a compensatory hypersecretion ensued from the healthy tissue remaining.

Our clinical observations indicate that the effects of photocoagulation are both more marked and more durable if the rays are focused in the substance of the ciliary body rather than on its surface. But this aug-

TABLE 2

EFFECT OF PHOTOCOAGULATION OF CILIARY BODY ON OCULAR TENSION IN OPEN-ANGLE GLAUCOMA

| Tensions (mm.Hg) Before Photocoagulation | Photocoagulations in Patients | | Ocular Tensions (mm. Hg) After Photocoagulation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Techniques | Weeks | | | | | | | | Months | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 3 | 6 |
| 32 | 1 | Transconj., superficial, 12 areas through 360° | 13 | — | 18 | — | — | — | — | 21 | 20 | — |
| 30 | 2 | 1·/transconj., superficial, 10 areas through 360° | 20 | 30 | — | — | — | — | — | — | — | — |
| 30 | | 2·/transconj., superficial, 12 areas through 360° | 15 | 13 | — | — | 27 | — | — | — | 11 | 20 |
| 26 | 1 | Transconj., superficial, 12 areas through 360° | 15 | 20 | — | — | — | — | — | — | 24 | — |
| 45 | 2 | 1·/transconj., superficial, 16 areas through 360° | 35 | — | — | 24 | — | 30 | — | — | — | 41 |
| 41 | | 2·/transcleral, 25 areas 180° temporal | 35 | 25 | — | 12 | — | 4 | — | — | — | — |
| 30 | | 1·/transconj., superficial, 12 areas through 360° | 20 | — | — | 23 | — | 22 | — | — | — | 26 |
| 26 | | 2·/transconj., superficial, 20 areas through 360° | 18 | 19 | — | 24 | — | 20 | — | — | — | — |
| 37 | 2 | 1·/transcleral, 15 areas 90° inféro-temporal | 16 | 20 | 35 | — | — | — | — | — | — | — |
| 35 | | 2·/transcleral, 15 areas 90° supéro-temporal | 14 | 10 | 11 | 11 | 13 | 11 | 11 | 12 | — | — |
| 26 | 1 | Transconj., superficial, 12 areas through 360° | 25 | — | — | — | — | — | — | — | — | — |
| 32 | 1 | Transconj., superficial, 8 areas through 360° | 13 | — | 21 | — | — | 20 | — | 24 | — | — |
| 26 | 1 | Transconj., deep, 25 areas through 360° | 13 | 26 | — | — | 20 | — | — | — | — | — |
| 24 | 1 | Transconj., deep, 16 areas through 270° | 13 | — | — | 24 | — | — | — | — | — | — |
| 68 | 2 | 1·/transscleral, 20 areas 180° inférior | 20 | 33 | — | 49 | — | — | 38 | — | — | — |
| 38 | | 2·/transconj., deep, 20 areas 180° inférior | 20 | 17 | 52 | — | — | — | — | — | — | — |
| 36 | 1 | Transconj., deep, 25 areas through 360° | 18 | 13 | 36 | 41 | — | — | — | — | — | — |

mented result in the reduction of ocular tension is accompanied by an aggravation of the postoperative ciliary reaction with more or less permanent implications, as manifested by hyphema, heterochromia iridis, and alterations in the size and reactivity of the pupil. As yet the desirable and undesirable effects cannot be dissociated. Unfortunately the reduction of ocular tension is but transitory when the procedure is innocuous while a lasting effect is obtained only through a marked and occasionally dangerous ciliary reaction. The dilemma is not unlike that involved in cyclodiathermy.

TABLE 3

EFFECT OF PHOTOCOAGULATION OF CILIARY BODY ON OCULAR TENSION IN APHAKIC GLAUCOMA

| Tensions (mm.Hg) Before Photocoagulation | Photocoagulations | | Ocular Tensions (mm.Hg) After Photocoagulation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Techniques | Weeks | | | | | | | | Months | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 3 | 6 |
| 40 | 2 | 1·/transconj., superficial, 12 areas through 360° | 35 | — | — | — | — | — | — | — | — | — |
| 35 | | 2·/transconj., superficial, 12 areas through 360° | 17 | — | 41 | — | — | — | — | — | — | — |
| 50 | 1 | Transconj., superficial, 18 areas through 360° | 55 | — | — | 32 | — | — | 26 | — | — | — |
| 31 | 3 | 1·/transconj., superficial, 20 areas through 360° | 37 | — | — | — | — | — | — | — | — | — |
| 37 | | 2·/transconj., superficial, 24 areas through 360° | 18 | — | — | 37 | — | — | — | — | — | — |
| 37 | | 3·/transconj., superficial, 20 areas through 360° | 39 | — | — | 39 | — | — | — | 29 | — | 17 |
| 50 | 3 | 1·/transconj., superficial, 20 areas through 360° | 32 | — | — | — | — | — | — | — | — | — |
| 32 | | 2·/transconj., superficial, 20 areas through 360° | 37 | 30 | 30 | 38 | 43 | — | — | — | — | — |
| 43 | | 3·/transscleral, 10 areas through 90° inféro-temporal | 23 | 35 | — | 50 | — | — | — | 65 | 34 | — |
| 35 | 3 | 1·/transconj., superficial, 12 areas through 360° | 13 | 23 | 28 | — | — | 36 | — | — | — | — |
| 36 | | 2·/transconj., superficial, 15 areas through 360° | 15 | 26 | — | — | — | — | — | — | — | — |
| 26 | | 3·/transconj., superficial, 12 areas through 360° | 11 | 8 | 11 | 12 | 9 | 11 | — | 13 | — | 20 |
| 35 | 1 | Transconj., superficial, 15 areas through 360° | 23 | 15 | — | — | — | — | — | — | 20 | 21 |
| 45 | 2 | 1·/transconj., superficial, 18 areas through 360° | 14 | 19 | 29 | 40 | — | — | — | — | — | — |
| 40 | | 2·/transconj., superficial, 15 areas through 360° | 28 | 39 | — | — | — | — | — | — | — | — |

## Conclusions

1. With the Meyer-Schwickerath apparatus the ciliary body can be reached by photocoagulation through the bulbar conjunctiva and sclera without opening the globe.

2. Photocoagulation of the ciliary body lowers the ocular tension both in the normal eye and that affected by primary or secondary glaucoma.

3. The lowering of ocular tension by photocoagulation apparently results from a lessened aqueous formation.

4. Further clinical research is required to determine whether photocoagulation of the ciliary body presents any advantage over cyclodiathermy.

*Hôpital de Bavière.*

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# EXPERIMENTAL PHOTOCOAGULATION OF THE ANTERIOR CHAMBER ANGLE*

### A preliminary report

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The filtration angles of cats, dogs and monkeys have been selectively coagulated by the photocoagulator of Meyer-Schwickerath,† thereby markedly altering the anatomy and physiology of the structures of the angle. The purposes of these experiments was to determine the feasibility of such coagulation and to study the effects produced by it.

## Methods and Materials

Ten cats, two dogs and nine monkeys were used. The animals were anesthetized with intravenous Nembutal. The tension of both eyes was taken with the Schiøtz tonometer. The recess of the anterior chamber was visualized through a Koeppe gonioscopic lens (fig. 1). In these species the structures of the filtration angle are highly pigmented, thus permitting selective absorption of the light energy emitted by the photocoagulator. The surface coagulation attachment of the instrument was used. The overload voltage selector was employed, using the second stage and a zero operculum with a 1.5-mm. diaphram.

During coagulation the angle was viewed

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† Meyer-Schwickerath, G.: Light Coagulation. St. Louis, Mosby, 1960.

Fig. 1 (Zweng and Flocks). Anterior chamber angle of the monkey visualized through a Koeppe lens. Gray patch denotes area of photocoagulation.

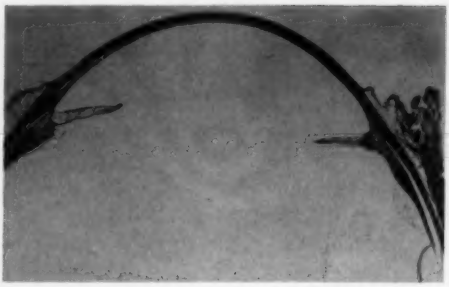

Fig. 2 (Zweng and Flocks). Monkey eye has been photocoagulated on both sides showing atrophy of anterior one half of the ciliary muscle and of ciliary processes.

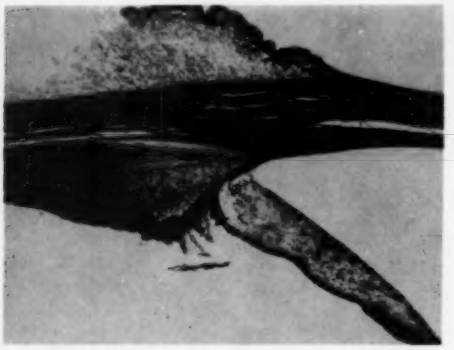

Fig. 3 (Zweng and Flocks). Higher power view of Figure 2. Note destruction of ciliary processes.

Fig. 4 (Zweng and Flocks). Higher power view of other side of Figure 2.

Fig. 5 (Zweng and Flocks). Extensive photocoagulation of angle has produced peripheral iridectomy and complete destruction of ciliary processes.

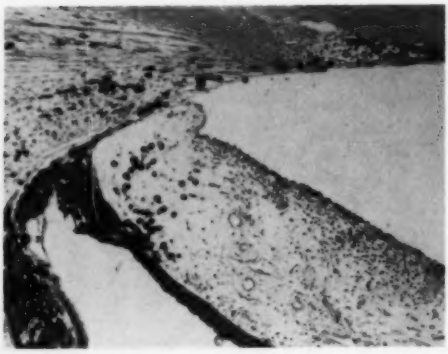

Fig. 6a (Zweng and Flocks). Higher power view of photocoagulated angle showing pigment accumulation and fragmentation of trabecular lamellae of meshwork, atrophy of ciliary muscle. Compare with Figure 6b.

by the operator not through the filter attached to the surface attachment but instead through a pair of dark glasses. The beam was directed into the chamber angle and the light was applied until a grayish patch appeared in the pigmented recess of the angle. The angle was treated in its entire circumference.

The tension was taken in both eyes immediately after coagulation was completed. The animals were followed subsequently with weekly tensions, slitlamp examinations and, whenever practical, serial tonographies. After the tension in each eye was the same for about one month, the animals were killed and the eyes examined histologically.

## Results

Since the monkey's chamber angle mechanism closely approximates that of the human, only the results obtained in monkeys will be discussed. However, the findings in the other two species used were in agreement with these reported in the monkey. The first observation made was that the pupil of the treated eye dilated and stayed dilated. The tension in the treated eye was lowered and stayed lower for from several weeks to several months, gradually returning to normal. The anterior chamber showed a mild aqueous flare and some cells, mostly pigmented, for several weeks. No anterior synechias were seen except in early cases in which photocoagulation was excessive. Serial tonographies suggest that aqueous formation and outflow are both decreased.

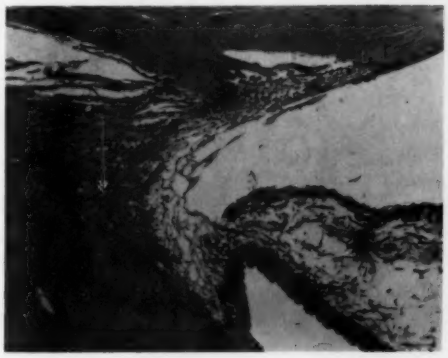

Fig. 6b (Zweng and Flocks). Normal monkey anterior chamber angle.

However, evidence on this point is not definitive because of the small number of animals studied tonographically. Microscopic studies show pathologic changes in the ciliary body and trabecular meshwork. These consist of accumulation of pigment cells and fragmentation of the trabecular lamellae, and atrophy of part of the ciliary muscle and destruction of ciliary processes (Figs. 2 through 6).

## Conclusions

1. Photocoagulation of the chamber angle can be readily and simply accomplished in the eyes of the animals listed.

2. Profound alterations have been produced in the trabecular meshwork and the ciliary body by this method.

3. Aqueous humor dynamics are actively influenced by it.

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## Ophthalmic Miniature

Young men mend not their sight by using old men's spectacles; and yet we looke upon Nature but with Aristotle's spectacles, and upon the body of man but with Galen's, and upon the frame of the world but with Ptolemie's spectacles.

John Donne, *Sermons lxxx*, 1626.

# SPECTRAL HUE LOCI OF NORMAL AND ANOMALOUS TRICHROMATES*

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## INTRODUCTION

For more than half a century, the Nagel anomaloscope has been the most dependable single device for the detection and differential diagnosis of the various types of red-green color blindness and has served as an almost infallible standard in the development of other color vision tests.

In describing its function, Walls[1] writes that the instrument "enables a testee to mix monochromatic red and green lights in any ratio, from zero of one to zero of the other. He sees the mixed light in a split field together with a monochromatic yellow light, whose brightness he can vary with a second control. A color-normal can make a perfect match of color and brightness over a range of only a couple of scale units on either dial. An ordinary deuteranomal identifies himself by setting the red-green mixture strongly greenish, to match the standard yellow. The *brightness* match he makes will satisfy the normal. The ordinary protanomal makes the mixture reddish; and, the redder he wants it, the dimmer the yellow he will use for his complete match since the luminosity of the red light is low for him. . . . When the anomal has made his average setting of the red-green control, its position will be separated by a number of scale units from its average position as set by the color-normal. This separation is the anomal's 'deviation'. . . ."

The effective red-green scale of the instrument ranges from zero (pure green) to 73 (pure red). Whereas, if the normal sets the knob at about 40 in order to match the monochromatic yellow, a deuteranomal might set it at 20, a protanomal at 60. The normal's choice looks too green to the protanomal, and too red to the deuteranomal. As to the reason for this Walls[1] points out that neither a depression of luminosity nor a particularly low saturation causes the anomal to require one light in the mixture in excess.

He hypothesizes that "a slight distortion of even one of the componential spectral responsivity curves (characteristic of anomalous trichromasy) necessarily displaces particular hues to new, 'abnormal' wavelengths. The anomal knows a sensation of, say, pure green (neither yellowish nor bluish) just as well as does the color-normal, but he and the normal do not get that sensation at just the same place in the spectrum. The anomal, at the anomaloscope, is not mixing what appear *to him* as a pure red and a pure green, to match something that appears *to him* a pure yellow. Naturally enough, he makes an 'anomalous' equation."

The major objective of the present work is to explore this theory of "hue displacement" in anomals. Three questions are involved: (1) With a given apparatus and procedure, where in the spectrum do color-normals find each of several "pure," or otherwise easily specified hues? (2) With the same apparatus and procedure, where do protanomals and deuteranomals find the same hues? (3) If anomals find them at wavelengths different from those of normals, do the directions and the extents of the displacements appear to account for the anomaloscopic deviations of anomals?

There are two minor objectives: (1) W. T. M. Forbes[2] suggested some time ago that there may be two kinds of color-normals: one obtaining qualitatively different sensations from "blue" and "violet" wavelengths, the other kind seeing violet stimuli as blue. (2) More recently Talbot[3] stated that certain

* From the Department of Ophthalmology, College of Medicine, State University of Iowa. Presented at the meeting of the Midwestern Section of the Association for Research in Ophthalmology, April, 1960, Indianapolis, Indiana.

data of Dimmick and Hubbard[4] point to the existence of two groups of color-normals: one finding pure green at λ500 mμ ± 5, the other at λ525 mμ ± 2. The additional purpose of the present study is to test these two hypotheses.

## Subjects

Color-normals were obtained from hospital personnel, town's people interested in a color vision check, and personal acquaintances. There were 278 normals, 57 percent female, 43 percent male. The ages ranged from 16 to 64 years.

Color-blind subjects, all male, were obtained by formal advertising. Of course, the relative numbers of different types in this sample did not necessarily correspond to those in an unselected local population.

The differential diagnosis was made with a Nagel anomaloscope in the manner outlined by Walls.[1] Ten protanopes and one "extreme" protanomal, as well as 14 deuteranopes and three extreme deuteranomals were excluded, while 12 "ordinary" protanomals and 32 "ordinary" deuteranomals were retained for the experiment.

The numbers of *normal* observers used in earlier attempts to locate "pure hues" (Dimmick and Hubbard,[4] Judd,[5] Hurvich and Jameson[6]) cannot be determined in all instances; but the number employed here was certainly larger than that used in any previous experiment, if indeed it did not exceed that of all previous studies combined.

Apparently *no* anomalous trichromates have been used in such an experiment before. General statements can be found (Jameson and Hurvich[7]) to the effect that λ589mμ ("sodium yellow") appears greenish to deuteranomals and reddish to protanomals, but there is no information regarding the wavelengths that elicit pure hue sensations in color defectives.

## Experimental design

The meaning of "pure" in the present context needs clarification.

We shall call the hue of a color "pure" when the color embodies only one kind of huedness, when the hue "contains nothing but itself." Thus yellow is a pure hue, but purple is not since it is a redness-blueness hybrid. Cyan contains blueness and greenness, but a pure green hue contains only greenness. There are actually only four pure hues: red, yellow, green, and blue. A color may present one of these without any trace of any of the other three. Most colors, however, are of hybrid hue, showing two of the four at once, in some relative magnitudes. Most of the colors given even by colorimetrically 100-percent pure lights have impure hues, for only in very narrow spectral bands (single wavelengths) do blueness, greenness, and yellowness stand alone. The consensus is that redness does not stand alone anywhere in the spectrum, but is everywhere "contaminated" by admixed yellowness which reaches a minimum and then increases again at the longest visible red wavelengths (Brindley[8]).

The aim in the present work was to have the observer(s) determine the particular wavelengths affording colors having pure hues, namely blue, green, and yellow. The hues of such stimuli may be called "unique" or "unitary," and indeed these terms are used more commonly than "pure." "Unique" is however ambiguous, inasmuch as certain stimuli, the hues of which may or may not be unitary or pure, are unique in that they do not change if the stimulus is moved away from the fovea or is changed greatly in intensity. The various criteria of uniqueness have been listed by Talbot,[3] all of them excepting "purity" being criticized by Hurvich and Jameson in an appendix to Talbot's article.

In the interest of simplifying the apparatus and exploring more subjects with less effort, no attempt was made to determine the make-up of a two-wavelength stimulus which would afford a purely red hue. Thus, each observer was asked to find a blue which was neither violetish (reddish) nor greenish, a green neither bluish nor yellowish, and a yellow neither greenish nor orangeish (reddish). In addition, he was required to locate,

as to wavelength, two spectral hues which are anything but pure: cyan, and orange, for it seemed not unreasonable to expect him to localize a blue-green in which blueness and greenness appeared equal in strength, and a red-yellow in which redness and yellowness similarly seemed to be on a par. These were the cyan and orange.

Earlier studies of pure-hue locations seem never to have been thus extended to any "50-50" hybrid hues. This was perhaps because no theoretical interest was then attached to such determinations, or the investigators assumed that the task would be too difficult for the subjects, or too inaccurately performed. However, the sizes of the standard deviations of settings for cyan and orange, as compared with those for the pure hues, speak for themselves (table 1).

The check of Forbes's hypothesis took care of itself, for it was only necessary to watch for subjects who, trying to locate a "purest blue" wavelength somewhere between greenish-blue and reddish-blue limits, found no reddishness coming into the sensation even at the shortwave limit of the spectrum and could therefore find no narrow locus of pure blue.

The check of Talbot's hypothesis similarly required no additional work by the observer(s), but only an examination of the data.

## Apparatus and Procedure

The apparatus was basically a fixed arm monochromator utilizing a constant deviation prism. The wavelength scale was calibrated with He and Hg sources and was easily read to an accuracy of 0.5 mμ. The exit slit, kept at 0.15 mm, passed a band of light 0.7 mμ wide at λ580 mμ. This band of essentially monochromatic light was sent through a neutral wedge and filled half of a circular field, subtending six degrees at the observing eye. The spectral source was a GE 500w 120v projection lamp.

The other half of the field was formed by a matte white surface reflecting the white light from a Macbeth 6500°K lamp, approximating the C.I.E. Source C. This white comparison field could be given a luminance of 10 mL or 1.0 mL, or turned off. In place of the monocromatic part of the field, an identical white could be substituted to form a solid white six-degree field. A fixation dot was always present at the center of the whole field.

The subject was instructed to use the wavelength control to librate ("bracket") for a color having a purely yellow hue, "neither the least bit greenish nor orangeish," and the other hues were located in the order green, cyan, orange, and blue following appropriate instructions. Before determining each hue, the subject was preadapted for three minutes to the solid white field, at either 10 mL or 1.0 mL. The monochromatic field-half was then uncovered and the subject made a preliminary setting of the wavelength control, concurrently matching the brightness of the spectral stimulus to the 10 mL or 1.0 mL white standard by adjusting the neutral wedge. The white field-half was then turned off and the subject refined his wavelength setting by further libration. The experimenter then "threw off" the wavelength knob and the subject readjusted it—altogether, six times. The entire series of hues was thus explored twice, so that each observer made 12 determinations of each hue locus at each luminance level.

## Results

Since no significant differences became apparent in the data for 10 mL and for 1.0 mL only the 10 mL data are reported here.

The data for the 278 color-normals, the 32 deuteranomals, and the 12 protanomals were kept separate. For each observer's 12 settings of a single hue, a standard deviation was calculated. The averages of these for all observers in a class are reported for each hue in Table 1. These results show the remarkable exactness with which the observers can find their "unique" loci.

The mean wavelengths at which the five hues were located and the corresponding

standard deviations are given in Table 2.

In regard to Forbes's hypothesis, only three of the 278 normals reported no change in hue as the wavelengths changed from blue to the ultraviolet limit, and among the 12 protanomals only one reported similarly. On the other hand, all but one of the 32 deuteranomals could see no difference; for them the blue color simply increased in saturation as the ultraviolet was approached. Since there is no reason to suppose that Forbes based his hypothesis upon a subject-population containing a large percentage of undiagnosed deuteranomals, and since, on the other hand, very few normals in our large sample saw violet as blue, it must be concluded that Forbes' idea remains unconfirmed.

The size of the standard deviation of the green loci determined by color-normals seemed to support the idea that the distribution might be bimodal (Talbot). On the other hand, the unusually wide scatter might merely reflect the well known fact that wavelength-difference limens are large in the green region and small in the neighboring (blue-green, yellow) regions (Nickerson and Granville[8]). In the latter case, however, the average scatter of the individual "pure green" settings of color-normals should be large, whereas table 1 shows it to be surprisingly small.

The frequency plot of the individual "pure green" loci is shown in Figure 1. Two statistical tests were made to determine if this distribution is normal. In the first, the data were compared with a normal distribution by means of a chi-square test. In the second, the data were divided into two sets, values under 520 mμ on the one hand, over 520 mμ on the other, and the means of the resulting distributions were compared by means of the t-test.[12]

TABLE 1

AVERAGE VALUES OF STANDARD DEVIATIONS FOR SINGLE-HUE SETTINGS (mμ)

| | 278 Color-Normals | 12 Protanomals | 32 Deuteranomals |
|---|---|---|---|
| Orange | 1.2 | 1.6 | 1.9 |
| Yellow | 0.9 | 1.4 | 1.3 |
| Green | 1.0 | 1.3 | 1.5 |
| Cyan | 0.8 | 1.1 | 1.2 |
| Blue | 1.4 | 2.1 | — |

It will be noted that for each class of observers the precision of settings for a 50–50 blue-green (cyan) and a 50–50 red-yellow (orange) was comparable to that of settings for pure hues.

In the first test, the value of chi-square was 48.4 with 25 degrees of freedom; it supports a value of $p < 0.01$. In the second test, it was found for the set of values under 520 mμ that $\overline{X}_1 = 514.1$, $S_1 = 2.4$, $N_1 = 195$, and for the set of values over 520 mμ $\overline{X}_2 = 525.0$, $S_2 = 2.5$, $N_2 = 83$. The formula

$$t = \left\{ \frac{\overline{X}_1 - \overline{X}_2}{S \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}} \right\},$$

where

$$S^2 = \left\{ \frac{N_1 S_1^2 + N_2 S_2^2}{N_1 + N_2 - 2} \right\}$$

yields the value of $t = 34.8$, which, again, makes $p < 0.01$. These values of p testify to the high degree of probability that there are

TABLE 2

MEAN WAVELENGTHS AT WHICH THE THREE CLASSES OF SUBJECTS LOCATED THE FIVE HUES AND THE CORRESPONDING STANDARD DEVIATIONS (mμ)

| | 278 Color-normals | 12 Protanomals | 32 Deuteranomals |
|---|---|---|---|
| Orange | 601.1 s.d. 2.4 | 590.4 s.d. 3.1 | 611.7 s.d. 3.4 |
| Yellow | 576.6 s.d. 2.0 | 563.1 s.d. 3.0 | 583.4 s.d. 2.9 |
| Green | 517.5* s.d. 5.7 | 501.7 s.d. 3.3 | 519.6 s.d. 3.5 |
| Cyan | 494.3 s.d. 1.7 | 488.4 s.d. 2.3 | 497.6 s.d. 2.1 |
| Blue | 468.3 s.d. 3.1 | 467.7 s.d. 4.0 | none* |

* See text.

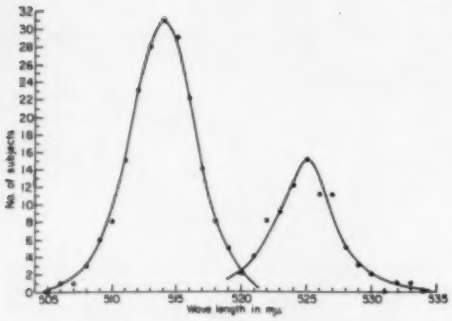


Fig. 1 (Rubin). Frequency distribution of color normals' spectral loci corresponding to "pure" green.

two separate "normal" green loci in the spectrum. It is noteworthy that the modes of the two sets of data are 514 and 525 as compared to the means of 514.1 and 525.0. This demonstrates the actual symmetry of the data about these means.

The 99-percent confidence intervals of the means in the two sets, computed from

$$\overline{X} = \pm 2.58 \frac{S}{\sqrt{N}}$$

are (513.66, 514.54) and (524.29, 525.71).

This analysis supports Talbot's idea of a bimodal distribution for "pure green" loci, with one locus, as conjectured, in the region of λ525. However, the other suggested locus λ500, falls considerably outside the 99-percent confidence interval for the mean λ514.1 of the present study. In the large sample of 195 normal subjects, 68 percent found their "pure green" on the average at λ514.1 mμ, and 32 percent at λ525.0 mμ.

## Discussion

The mean loci of 10 mL spectral orange and cyan, 601.1 mμ and 494.3 mμ respectively, determined for the large number of color-normals of the present study, are offered for whatever value they may have to theorists. It may be noted that one of Hurvich and Jameson's[6] two observers, dark-adapted for 10 minutes, found his "pure green" at a wavelength shorter than 494.3.

The determinations of mean normal yellow, green, and blue loci may or may not be of value. It is realized that differences in apparatus, luminance level, criteria of "uniqueness," and psycho-physical procedure may significantly affect the results. Bouman and Walraven[10] have listed the factors that can profoundly influence the color seen in a particular light.

The point of this study was to compare the hue localizations of protanomals and deuteranomals with those of color-normals under the same procedural conditions. The data appear adequate to warrant such comparison, and the differences found are believed to be valid as to direction and extent, regardless of the absolute values.

The (average) deuteranomal finds pure green about where the undifferentiated normals do (Table 2). He finds pure yellow and mid-orange at somewhat longer wavelengths than the (average) normal. He should perceive the anomaloscopic λ589 mμ (which lies between pure yellow and pure orange for all three groups) as less reddish, more yellowish, than it looks to the normal. The anomaloscopic λ546 mμ is about half-way between pure green and pure yellow for both groups, and should have about the same hue for both. The anomaloscopic 670 mμ is so far from the mid-orange for both groups that its hue should be little different for them. Ordinarily it is said that the deuteranomal, in matching the yellow at the Nagel, takes *more green* than the normal. It now appears that one should rather say that the deuteranomal requires *less red;* for the 589 he is matching with 546 and 670 appears to him less reddish, so that he requires less of the 670. He might even take still less of 670 if the design of the instrument were not such as to increase 546 when 670 is decreased.

The case of the (average) protanomal is more complex. He finds all five hues at wavelengths shorter, 9.0 mμ on the average, than the normal. To him 546 mμ should appear but little greenish, mostly yellowish while 589

mμ must appear almost perfectly mid-orange, quite a bit more reddish, less yellowish, than it looks to the normal; the λ670 mμ redder, less yellowish, since his mid-orange is farther from 670 than the normal's. He needs very little redness (670) to change the slight greenness of *his* 546 into his pure yellow. He needs additional redness to equal the redness content of his 589. But it is not so readily seen that this means he needs more 670 than the normal. The fact is, he takes more.

How much of this is due to the fact that 670 (and to a lesser extent, 589) is depressed in luminosity for the protanomal? Perhaps none of it; for, the female genetic "carrier" of protanomaly or protanopia may have a spectral luminosity curve like that of a protanomal or a protanope (Schmidt[11]), but makes normal settings at the Nagel anomaloscope. It is suggested that relative differences of saturation at the three anomaloscopic wavelengths—546, 589, 670—may partly or wholly explain why the protanomal requires more 670 than the normal in matching 589.

In short, it seems safe to conclude that the displacements of various hues to "abnormal" wavelengths can explain why the deuteranomal requires an excessive ratio of 546 to 670, to match 589. In regard to the protanomal, hue displacements cannot be dismissed as a factor but do not obviously account for his excessive ratio of 670 to 546.

## Summary

The principal aim of this study was to examine Walls' hypothesis that the anomalous trichromat has a hue wavelength correlation that differs from that of the normal; in other words, that, for the anomalous trichromat, hues are displaced to "abnormal" wavelengths.

Two additional ideas were checked, namely, Forbes's suggestion that there is a group of color-normals that sees spectral violet as blue, and Talbot's hypothesis that there are two groups of color-normals with different wavelength loci for pure green.

A total of 278 normals, 12 protanomals, and 32 deuteranomals was asked to determine the wavelengths corresponding to yellow, orange, green, cyan and blue. For this a fixed arm monochromator was used with a constant deviation prism and a central six-degree visual field half of which could be filled with essentially monochromatic light. With brightness held constant at 10 mL and 1.0 mL, successively, the subject was requested to locate the hues by the method of libration or "bracketing." There was no significant difference in the data of the two luminance levels. The standard deviations of the single hue settings of an individual observer were remarkably small. The mean wavelengths at which the three classes of subjects located the five hues and the corresponding standard deviations are presented.

Forbes' idea was not substantiated. However, it was found that deuteranomals cannot distinguish spectral violet from spectral blue. Talbot's idea of a bimodal distribution of color-normals' loci for pure green was confirmed. The average loci, however, were found at 525 mμ and at 514 mμ instead of, as he had surmised, at 525 and 500.

The average deuteranomal finds pure yellow and mid-orange at somewhat longer wavelengths than does the average normal, and this can explain his particular performance at the anomaloscope. The average protanomal finds all his pure hues at wavelengths shorter than the average normal. However, these displacements do not obviously account for his anomaloscopic performance.

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# THE A AND V SYNDROMES*


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The marked variation in the angle of horizontal strabismus in the straight-up and straight-down positions of gaze, which is characteristic of the A and V syndromes, was emphasized by Urist in a series of articles[1-6] This author pointed out that 40 percent of patients with strabismus could be gathered into one of the four following groups: (1) esotropia, greater looking down than up, with bilateral elevation in adduction; (2) esotropia, greater looking up than down, with bilateral depression in adduction; (3) exotropia, greater looking up than down, with bilateral elevation in adduction; and (4) exotropia, greater looking down than up, with bilateral depression in adduction.

After reading Urist's articles, I added to the routine examination of the six cardinal directions of gaze in my patients with strabismus the study of the straight-up and straight-down gazes. I was very surprised to note the frequency with which the angle of horizontal deviation differed so considerably in these two positions of gaze that in some cases the squint even disappeared completely in one of them. Indeed, it seemed strange that this simple fact could have been overlooked before.

In 1955, I published an article[7] in which I stressed the importance of studying the variations in the angle of horizontal strabismus looking straight up and down so as to be able to separate the vertical deviations that coexist with a horizontal strabismus into one of the two following groups: *Group A*, primary vertical strabismus; and *Group B*, secondary vertical strabismus. I also demonstrated the existence of mixed cases *(Group C)*, such as Case 16 in my paper which displayed a V esotropia (Urist's Group 1) in combination with a *primary* (and unequal) bilateral paresis of both superior recti.

The classification of squints with vertical deviations, which I suggested in 1955[7] and am still using up to the present day, is as follows:

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GROUP A: PRIMARY VERTICAL STRABISMUS
(With or without added horizontal deviation.)

1. Paresis of an elevator or depressor muscle in one eye.
2. Paresis of both elevator or depressor muscles in one eye.
3. Bilateral paresis (or spasm) of twin (homonymous) muscles.
4. Mixed or multiple paresis.
5. Concomitant hypertropia (or phoria).
6. Dissociated vertical divergence.

GROUP B: SECONDARY VERTICAL STRABISMUS
(Urist's syndromes. New name: A and V syndromes.)

1. Esotropia with bilateral elevation in adduction.
2. Esotropia with bilateral depression in adduction.
3. Exotropia with bilateral elevation in adduction.
4. Exotropia with bilateral depression in adduction.

GROUP C: MIXED CASES

In Group C, any of the six varieties of primary vertical strabismus (Group A) may be combined with the secondary vertical deviations typical of Group B (Urist's syndromes).

As may be seen, the criterion adopted for my classification was based on Urist's theory that the vertical deviations of the A and V syndromes were secondary to the horizontal strabismus, a point of view with which many ophthalmologists disagree.

The purpose of this study is precisely to marshal arguments in favor of Urist's belief that, in the A and V syndromes, the changes in the horizontal angle of deviation in the straight-up or straight-down positions of gaze are caused by dysfunctions of the horizontal rectus muscles, and that the coexisting bilateral vertical deviations are usually secondary in nature.

On the other hand, a number of authors[8–12] contend that the bilateral vertical deviations (paresis and/or spasms of homonymous or twin muscles) constitute the primary disturbance, and that the variations in the horizontal angle of deviation in the upward or downward gazes are due to the secondary action of abduction or adduction on the part of the vertical muscles involved.

Brown[8] explains this mechanism clearly in his example of a paresis of both superior recti: "In upward gaze there is a divergence of the visual axis. The superior rectus muscles are primarily underacting with a decrease in their adduction action. The inferior obliques are secondarily overacting with an increase in their abduction action which tends to carry the eyes up into a divergent position. In downward gaze the superior oblique muscles are secondarily underacting with a decrease in their abduction action. The inferior rectus muscles are secondarily overacting with an increase in their adduction action which tends to carry the eyes down into a convergent position."

Although this mechanism seems to exist in certain cases, which are generally distinguished by the absence of horizontal strabismus in the primary position (for example, approximately straight looking forward, divergent looking up, convergent looking down), the great majority of the A and V syndromes are caused by dysfunctions of the horizontal rectus muscles, as will be proved by the case reports that will follow.

It seems difficult to accept a priori that such a large number of patients with strabismus should suffer from a primary paresis of a homonymous vertical muscle in each eye. If this were the mechanism, the A and V syndromes ought to be relatively infrequent. Burian[13] acknowledges that "when one's attention has been called to these syndromes, one is surprised to note how frequently they are encountered."

It also seems rather strange that so much significance should be attached to the action of abduction or adduction in the vertical muscles, an action that has otherwise been

considered of scant practical importance. In fact, this secondary action has been left out of account for years in the study of vertical diplopias, since the prior existence of a slight heterophoria suffices to change the lateral position of the images that would be expected in accordance with the secondary action of abduction or adduction of the vertical muscle affected, thus transforming a homonymous diplopia into a crossed diplopia or vice versa.

Hence, it is difficult to imagine that a typical V esotropia, as for example 0 degrees looking up and +20 degrees looking down, could be produced by the secondary action of adduction of the inferior recti not counterbalanced by the action of abduction of the paretic superior obliques. It should be borne in mind that the inferior recti are primarily depressors, secondarily extortors, and only in the third instance act slightly as adductors.

The following clinical arguments have been adduced in favor of the idea that the bilateral vertical deviations in the A and V syndromes are primary and not secondary in nature:

1. Cases of A and V syndromes without horizontal strabismus in the primary position.

2. Cases in which vertical deviations persist after the horizontal muscles have been operated on, and a second operation is needed to correct the vertical defects.

As regards the former argument, I agree that it is possible to come across A and V syndromes without horizontal strabismus in the primary position, but such cases are in a minority. The great majority of patients with A and V syndromes manifest a convergent or divergent squint in the primary position of gaze.

The second argument (that vertical deviations persist after the horizontal muscles have been operated on) is quite often true and has been responsible for most of the confusion in the interpretation of these syndromes. It has two possible explanations: (a) addition of a secondary contracture in the vertical muscles which have suffered a functional spasm for a long time (for example, synkinetic overaction of the inferior obliques in a V esotropia, followed later by an irreversible contracture of their muscle tissue); (b) mixed cases (Group C in my classification) in which a primary paresis of two homonymous vertical muscles is combined with a horizontal strabismus of the A or V type. In the latter case, the initial defect may be an unequal bilateral paresis of twin muscles (for example, both superior obliques), which disrupts binocular vision. If the child is hypermetropic, a V esotropia may easily be added as a result of overaction of the medial recti.

Case 16 in this paper is a typical mixed case, which could be classified correctly as such before surgery was undertaken.

The following arguments support Urist's theory that the A and V syndromes are produced by dysfunctions of the horizontal muscles:

1. Correction of the different angle of strabismus that exists in the upward and downward gazes through proper surgical treatment of the affected horizontal muscles.

2. Uneven results in the straight-up and straight-down positions of gaze as the result of an operation mistakenly performed on nonaffected horizontal muscles.

3. Elimination of bilateral vertical deviations after an operation on the horizontal muscles only.

4. Delayed appearance of vertical deviations (previously nonexistent) *after* the establishment of a horizontal squint.

5. Replacement of one syndrome by another (for example, A by V), with conversion of the apparent underaction of the vertical muscles into the opposite defect (spasm), after an operation on the horizontal muscles only.

6. A and V syndromes *without* abnormalities in the action of the vertical muscles.

7. Postoperative A and V syndromes, in squints which were previously comitant in the straight-up and straight-down positions of gaze.

Arguments 1, 2, 3 and 5 have been dealt

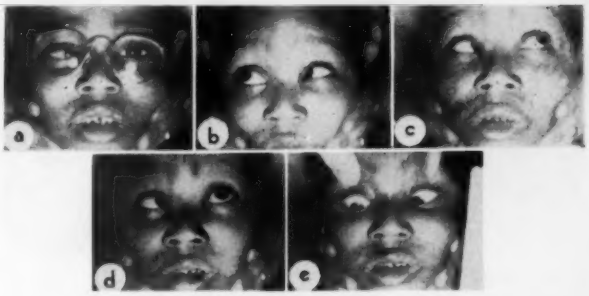

Fig. 1 (Villaseca). A-esotropia: +40 degrees looking up (d) and +15 degrees to +20 degrees looking down (e). Marked underaction of the inferior obliques (b, c). (Reproduced by permission of M. J. Urist, Am. J. Ophth., **46**: 838, 1958.)

with by Urist in his articles and illustrated by photographs of many case reports. For instance, his Case 4[14] is a patient who clearly shows the effects of incorrect surgical treatment (argument 2), consisting of recession of both medial recti in an A esotropia. There was a 30 to 35 arc degrees esotropia in the primary position, +35 degrees in the straight-up gaze and only +5.0 to +10 degrees in the straight-down gaze. In spite of the strongly marked esotropia in the primary position (30 to 35 degrees), overcorrection resulted from a four-mm. recession of the medial recti, and led to an exotropia of 10 degrees in the primary position, −5.0 to −10 degrees looking up and −20 degrees looking down. In this case, the proper surgery for an A esotropia would have been the resection of both lateral recti.

The transformation of one syndrome into another by an operation on the horizontal muscles only (argument 5) is beautifully illustrated in Urist's Case 2.[14] The patient had an A esotropia with marked underaction of the inferior obliques (fig. 1). Resection of both lateral recti and recession of the left medial rectus changed the clinical picture, and a V esotropia with moderate spasm in both inferior obliques (fig. 2) made a tardy appearance. It is noteworthy that by an operation on the horizontal muscles only and the passage of time, the apparent paralysis of both inferior obliques (fig. 1-b, c) was changed into a spasm (fig. 2-d, e); this confirms that the vertical deviations in this patient were of a secondary nature.

In support of arguments 1 and 3, I will present some illustrative case histories in the following pages. A patient will also be reported on in whom the spasm of the inferior obliques was obviously secondary, since it did not appear until one year after the establishment of the convergent strabismus (argument 4).

I wish to lay special emphasis on arguments 6 and 7, since they do not appear to have been accorded sufficient importance before. The fairly frequent appearance of A and V syndromes *without* vertical deviations (argument 6) is, in fact, categorical proof that these syndromes can be produced by dysfunctions of the horizontal muscles only. Some typical examples will be reported in order to illustrate this point. The appearance of A and V syndromes after surgery on the horizontal muscles in squints that were pre-

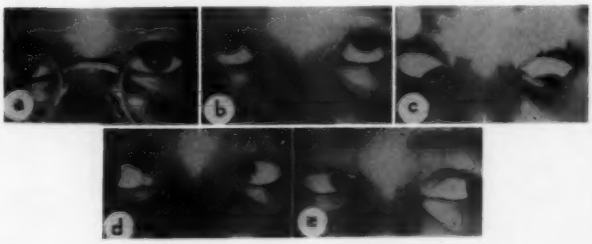

Fig. 2 (Villaseca). Ten years after resection of both lateral recti and recession of the left medial rectus. V-esotropia: 0 degrees looking up (b) and +20 degrees looking down (c). Moderate overaction of the inferior obliques (d, e). (Reproduced by permission of M. J. Urist, Am. J. Ophth., **46**:838, 1958.)

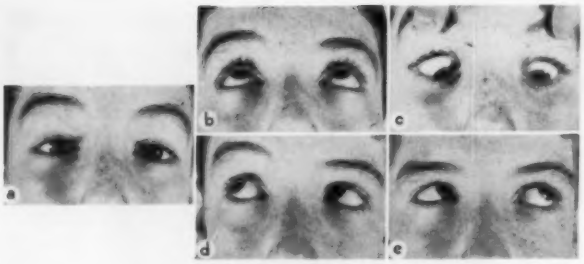

Fig. 3 (Villaseca). (Case 1.) V-esotropia without spasm of the inferior oblique muscles. Fifteen arc degrees of esotropia in the primary position (a), 3.0 degrees looking up (b) and 25 degrees looking down (c). Eyes level in the diagonal directions of gaze (d, e).

viously comitant in the straight-up and straight-down positions of gaze (argument 7), demonstrates in a quasi-experimental way that the horizontal muscles are the ones to blame.

### A. "A" AND "V" SYNDROMES WITHOUT VERTICAL DEVIATIONS

A and V syndromes without vertical deviations are very common. Some typical examples follow.

CASE 1

M. R. had an intermittent convergent strabismus of the right eye since the age of three years. He was first seen at the age of six years (May, 1951) with an intermittent right esotropia of about 10 degrees. Ocular motility was normal in the four diagonal directions of gaze. As Urist's articles had not yet been published, no note was taken of the degree of horizontal deviation in the straight-up and straight-down positions of gaze.

Skiascopy under atropine cycloplegia showed hypermetropia of 1.5D., O.U. Glasses were prescribed: O.U., +0.75D. sph.

At eight years of age, he showed a 15-degree esotropia in the primary position (fig. 3-a), which decreased to about +3.0 degrees looking up (fig. 3-b) and increased to +25 degrees on looking down (fig. 3-c). He had not worn his glasses. Vision was 20/40, O.D.; 20/30, O.S., and the study of versions did not reveal any vertical deviations (fig. 3-d, e). Synoptophore: fixing O.U. = +16° Θ s/c. Fusion at this angle.

The patient was then classified in Urist's Group 1 (now called V esotropia), although there was no bilateral elevation in adduction. As the absence of the characteristic vertical deviations, described by Urist, was thought to be an interesting finding in a patient who showed a marked difference between the angle of horizontal deviation in the upward and downward gazes, the case was included in a photographic demonstration of "Different types of strabismus" which I gave at the First Chilean Congress of Ophthalmology, held at Concepción on November 12, 1953.

Recession of both medial recti was advised, but the parents did not agree to an operation.

Up to his last examination at 11 years of age, he had not worn his glasses. A typical V strabismus still existed (cover test for near: +10 degrees in the primary position, 0 degrees looking up and +25 degrees looking down), with normal ocular motility in all directions. The cover test for distance showed an alternating strabismus of +7.0 degrees. Vision, O.U. = 20/30 p. Synoptophore: fixing O.U. = +18° L/R 2 △. Fusion at +12° L/R 2 △.

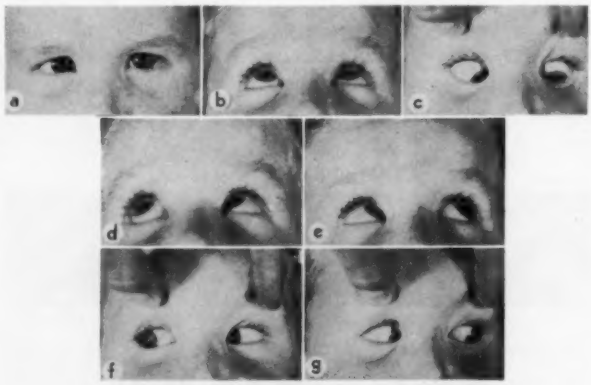

Fig. 4 (Villaseca). (Case 2.) V-esotropia without vertical deviations: +7.0 degrees in the primary position (a) (epicantus simulates larger angle of deviation), +3.0 degrees looking up (b) and +20 degrees looking down (c). Eyes level in the diagonal directions of gaze (d, e, f, g).

*Comment.* This patient was the first case in which I noticed and photographed a typical V esotropia without vertical deviations (1953). No change took place in the V syndrome during an observation period of three years, and at no time was there any spasm of the inferior obliques.

CASE 2

F. A. began to have an intermittent convergent squint, O.D., at the age of two years. At three years of age the strabismus became permanent and the parents decided to seek advice.

Examination revealed a right permanent esotropia of 10 to 15 degrees which did not vary in the straight-up and straight-down positions of gaze. Under atropine cycloplegia the angle of deviation decreased to about +5.0 degrees. Glasses were prescribed: O.D., +6.5D. sph.; O.S., +5.5D. sph. ⊂ +1.0D. cyl. ax. 70°. Part-time occlusion, O.S., was ordered.

At the age of four years, the patient displayed an alternating esotropia of about 7.0 degrees with or without glasses (Fig. 4-a). The deviation decreased in the upward gaze to about +3.0 degrees (as estimated with the alternate cover test) and increased to approximately +20 degrees when looking down (fig. 4-b, c). In the diagonal directions of gaze no vertical deviation was apparent (fig. 4-d, e, f, g), a fact that was corroborated by the lack of any vertical movement of the eyes when the alternate cover test was carried out in these positions. The diagnosis was a V esotropia without spasm of the inferior obliques. Synoptophore: fixing O.U. = +15° θ c/c and +23° θ s/c. Fusion with oscillation only.

At surgery on March 5, 1959, bilateral five-mm. recessions of the medial rectus muscles were done.

When last seen 25 days after the operation, there was no strabismus in either the primary position (with or without glasses) or looking up (fig. 5-a, b). In the downward gaze a squint of +5.0 degrees was perceptible (fig. 5-c). The cover test showed no vertical defects in the four diagonal directions of gaze. Synoptophore: simultaneous perception and fusion at +4° L/R 2 △ (c/c).

*Comment.* This patient had a typical V esotropia (+3.0 degrees looking up and +20 degrees looking down), with no spasm of the inferior obliques.

Symmetrical surgery (recession of both medial recti) produced an immediate asymmetrical effect in the upward and downward gazes. In the former, the deviation of +3.0 degrees was reduced to 0 degrees (3.0 degrees corrected) and in the latter, the deviation of +20 degrees was reduced to 5.0 degrees (15 degrees corrected). Therefore, as Urist has pointed out, surgery of the medial recti would seem to have a greater effect in the straight-down position of gaze.

Fig. 5 (Villaseca). (Case 2.) Twenty-five days after recession of both medial recti. Negative cover test in the straight forward (a) and upward gazes (b). Esotropia of 5.0 degrees looking down.

No vertical deviations were to be seen either before or after surgery. In this case, the V syndrome was attributable solely to the overaction of the medial recti, since recession of these muscles produced the desired effect.

CASE 3

A. M., aged four years, started to show an intermittent esotropia, O.S., when three years of age, which later became permanent.

Examination revealed a left esotropia of about 20 degrees with moderate amblyopia ex anopsia. The angle of deviation diminished to +10 degrees when looking up and increased to +25 degrees when looking down. The cover test in the diagonal positions of gaze did not disclose any vertical deviation. Synoptophore: fixing O.U. = +23° θ. Glasses were prescribed (O.D., +2.0D. sph.; O.S., +2.25D. sph.), and occlusion, O.D., was ordered.

At successive check-ups one, two and eight months later, a V esotropia (15 degrees in the primary position, 7.0 degrees looking up and 20 degrees looking down) without vertical deviations was always evident. Cover measurements (with and without glasses) were: ET 35 △; ET' 40 △. Synoptophore: fixing O.U. = +25° θ c/c. Vision became equal in both eyes.

At surgery, on September 1, 1958, bilateral five-mm. recessions of the medial rectus muscles were done.

A month later, a residual esotropia of 7.0 degrees in the primary position (with and without glasses), +3.0 degrees looking up and +10 degrees looking down existed. Synoptophore: fixing O.U. = +12° L/R 2 △, with abnormal retinal correspondence. Orthoptic exercises were prescribed.

Three months after surgery, the cover test for distance and near showed only a very slight esotropia (about 2.0 degrees). There was no difference in the upward and downward gazes. Synoptophore: fixing O.U. = +11° θ c/c. Fusion at +8° θ.

When last seen, 10 months after surgery, the cover test for distance and near was negative (with and without glasses), as well as in the straight-up and straight-down positions of gaze. Ocular mo-

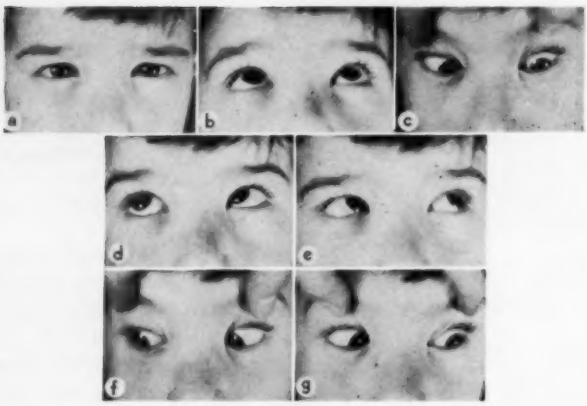


Fig. 6 (Villaseca). (Case 4.) V-esotropia without vertical deviations: +10 degrees in the primary position (a), 0 degrees looking up (b) and +15 degrees to +20 degrees looking down (c). Eyes level in the diagonal directions of gaze (d, e, f, g).

tility continued to be normal in the four diagonal directions of gaze.

*Comment.* This patient had a V esotropia (+7.0 degrees looking up and +20 degrees looking down) which failed to show the least sign of a vertical deviation in successive check-ups over an eight-month period. It should be noted that in order to ensure that no vertical defect exists I make an alternate cover test in the four diagonal directions of gaze as a matter of routine.

A bilateral recession of the medial rectus muscles left a slight residual squint for a few months, which later disappeared completely. Symmetrical surgery therefore produced an asymmetrical effect since it corrected a deviation of +7.0 degrees in the upward gaze and of +20 degrees in the downward gaze, that is, the total degree of strabismus that had previously existed in those two positions.

This demonstrates that recession of the medial recti is the operation of choice for V esotropias.

CASE 4

R. R. had had an intermittent convergent strabismus of the right eye since he was a baby.

When first seen, at the age of seven years, the patient had just been examined by a colleague under atropine cycloplegia. The cover test for distance varied, at one moment showing binocular fixation and at another a right esotropia of about 7.0 degrees. The cover test for near demonstrated a small angle (3.0 to 5.0 degrees) permanent right esotropia, which decreased to 0 degrees in the upward gaze and increased to approximately 7.0 degrees in the downward gaze. Glasses were prescribed: O.U., +1.5D. sph. Vision c/c was 20/40 p., O.U.

Four months later (July, 1959) the cover test for distance showed only an esophoria of about 5.0 degrees c/c, and an intermittent right esotropia of about 7.0 degrees s/c. The cover test for near revealed a permanent right esotropia of about 7.0 degrees c/c and about 10 degrees s/c (fig. 6-a). The cover test was negative in the upward gaze (fig. 6-b), and in the downward gaze the squint increased to 15 or 20 degrees (fig. 6-c). In the four diagonal directions of gaze the cover test did not disclose any vertical deviation (fig. 6-d, e, f, g).

Synoptophore: fixing O.U. = +17° Θ (c/c and s/c). Simultaneous perception and fusion at this angle. No stereopsis.

Since the patient has no squint when looking at distant objects with glasses and shows fusion in the synoptophore, he will be kept under observation for a long time.

*Comment.* This patient displays a V esotropia (0 degrees looking up and 15 to 20 degrees looking down) with an accommodative element. No vertical deviations exist.

Permanent use of glasses (if necessary bifocals) may attenuate his overconvergence in the long run, since his eyes are straight for distance with glasses and fusion does exist. If no improvement is noted after a couple of years, a recession of the medial recti could be done, since this is the operation of choice for V esotropias.

CASE 5

M. S. developed a left convergent strabismus at the age of one and one-half years.

She was first seen when four years of age and found to have a convergent strabismus of 15 degrees in the left eye with marked amblyopia ex anopsia (counting fingers). The esotropia decreased to about 7.0 degrees in the upward gaze and increased to about 30 degrees in the downward gaze. There was no vertical deviation in any of the four diagonal directions of gaze.

Permanent occlusion was ordered (patch six days, O.D., and one day, O.S.). Over a period of six months the vision of the left eye gradually improved until it was almost the same as that of the right eye (O.D., 20/60; O.S., 20/80 p.). A left esotropia of about 10 degrees in the primary position, +3.0 degrees looking up and +20 degrees looking down persisted. Glasses were prescribed (O.D., +3.0D. sph. ⌒ +1.0D. cyl. ax. 90°; O.S., +5.0D. sph. ⌒ +0.5D. cyl. ax. 90°), and further occlusion ordered.

The patient wore glasses permanently for 10 months but discontinued the occlusion, and only returned for a check-up one month after she had broken her glasses.

Vision, O.S., had diminished to 10/120. The cover test for distance showed a left esotropia of about 5.0 degrees c/c and +10 degrees s/c. The cover test for near showed an esotropia of about 7.0 degrees c/c and 15 degrees s/c in the primary position (fig. 7-a). The squint decreased to +5.0 degrees in the upward gaze (fig. 7-b) and increased to +30 degrees in the downward gaze (fig. 7-c). Motility was normal in the four diagonal directions of gaze (fig. 7-d, e). Synoptophore: fixing O.U. = +19° Θ c/c and 26° Θ s/c.

*Comment.* This child had a partly accommodative esotropia, with 2.0D. of anisometropia and marked amblyopia ex anopsia. A typical V esotropia existed (+5.0 degrees looking up and +30 degrees looking down) without vertical deviations, which remained unmodified during successive periods with occlusion (six months) and without occlusion (10 months) of the fixing eye. It should be noted that this patient, who had an unmistakable V esotropia, did not reveal a spasm of the inferior obliques at any time (fig. 7-d, e), even in the left eye which was markedly amblyopic. Once the amblyopia improves, the operation that should be performed is a recession of the medial recti (V esotropia). A recession-resection operation on the squinting eye is not advisable in this case, since it would undoubtedly lead to overcorrection in the straight ahead and upward gazes.

CASE 6

F. C. presented since birth an alternating convergent strabismus. At the age of six years he began to wear glasses: O.U., +5.0D. sph.

At eight years of age, the cover test for distance and near showed an alternating esotropia of 15 degrees (with and without glasses). The strabismus showed no change in the upward gaze (+15 degrees) but in the downward gaze it decreased considerably (+5.0 degrees). Ocular motility was normal in the four diagonal directions of gaze. The diagnosis was an A esotropia, with no demonstrable deviation in the vertical muscles.

Vision was 20/60, O.D.; 20/40, O.S. Cover measurements with glasses were: ET 30 Δ, LH 8 Δ; ET′ 40 Δ, LH′ 8 Δ. The left hypertropia could also be seen in the synoptophore: fixing O.D. = +18° L/R 14 Δ; fixing O.S. = +15° L/R 6 Δ (c/c). Abnormal retinal correspondence was present.

At surgery, on January 12, 1959, bilateral eight-mm. resections of the lateral rectus muscles were done.

Two months after surgery, there was a slight residual esotropia (2.0 to 5.0 degrees), which was the same in the upward and downward gazes. In supradextroversion, the cover test showed a slight spasm of the left inferior oblique. Synoptophore: fixing O.D. = +10° L/R 14 Δ; fixing O.S. = +10° L/R 7 Δ. As the abnormal retinal correspondence persisted, orthoptic exercises were prescribed.

At the last check-up six months after surgery, the patient showed a residual esotropia of 5.0 degrees with the cover test for distance (with and without glasses), and of a bare +2.0 degrees with the cover test for near (c/c and s/c). There was

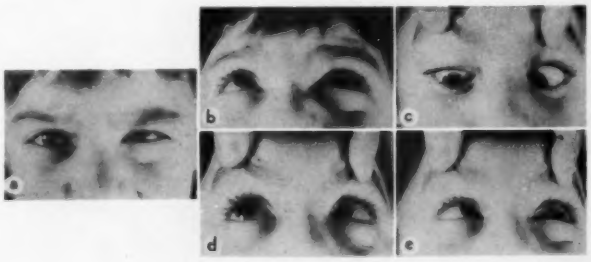


Fig. 7 (Villaseca). (Case 5.) V-esotropia with marked amblyopia exanopsia of the left eye, without vertical deviations: +15 degrees in the primary position (a), +5.0 degrees looking up (b) and +30 degrees looking down (c). Eyes level in the diagonal directions of gaze (d, e).

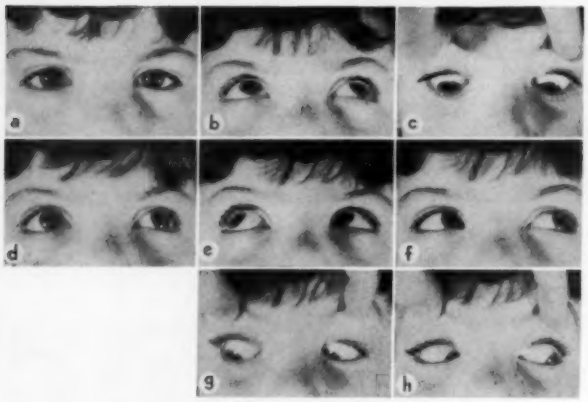


Fig. 8 (Villaseca). (Case 7.) V-exotropia without vertical deviations. Intermittent divergent strabismus of about 15 degrees in the primary position (a, d), permanent exotropia of 25 to 30 degrees looking up (b) and perfect orthophoria looking down (c). Eyes level in the diagonal directions of gaze (e, f, g, h).

no difference between the upward and downward positions of gaze. A slight spasm of the left inferior oblique remained. Vision was: O.D., 20/40 p.; O.S., 20/30 p. The synoptophore showed a reduction in the degree of left hypertropia: fixing O.D. = +9° L/R 7 △; fixing O.S. = +8° θ (c/c). There was alternate suppression (mainly, O.D.).

*Comment.* This case was one of A esotropia (+15 degrees looking up and +5.0 degrees looking down), with apparently normal motility of the vertical muscles in the preoperative examination. However, the cover measurements and synoptophore detected a slight left hypertropia.

Symmetrical surgery (resection of the lateral recti) corrected a higher degree of strabismus in the upward gaze (+13 degrees) than in the downward gaze (+3.0 degrees), and six months after the operation only a slight residual squint (+2.0 degrees for near) remained, which was the same looking up and down. The cause of the left hypertropia was postoperatively discovered to be a slight spasm of the left inferior oblique. As the hypertropia has tended to decrease, the patient will be kept under observation for a year or two before it is decided whether the vertical deviation is primary or secondary.

This slight vertical deviation can in no way be held responsible for the A esotropia, since in this syndrome the type of defect which should be found is exactly the opposite, that is, underaction of the inferior obliques instead of spasm.

This case could have been included in the next section, together with the patients who have only slight vertical deviations which, because of their degree or type, bear no relation to the corresponding A or V syndromes.

CASE 7

This was a private patient of Dr. José Espíldora, who kindly allowed me to examine and photograph the girl for inclusion in this paper.

N. E., aged three years 10 months, had had an intermittent divergent strabismus, O.S., since she was a baby.

Examination revealed an intermittent left exotropia of about 15 degrees in the primary position (fig. 8-a, d), with a permanent exotropia of 25 to 30 degrees looking up (fig. 8-b) and a perfect orthophoria looking down (fig. 8-c). Both Dr. Espíldora and I repeatedly verified that the alternate cover test in the downward gaze was totally negative. There was not the slightest trace of exophoria in this position in contrast to the marked exotropia which appeared as soon as the patient raised her eyes a little (fig. 8-d).

No vertical deviation was apparent in the diagonal directions of gaze (fig. 8-e, f, g, h). The power of convergence was normal.

Vision. O.U., was 20/30. Cover measurements were: XT 30 △; XT′ 25 △. Synoptophore: fixing O.U. = −10° θ; fusion at this angle.

Skiascopy under atropine cycloplegia showed hypermetropia of 1.5D., O.U.

The diagnosis was a V exotropia without vertical deviations.

At surgery, on November 4, 1959, Dr. Espíldora performed bilateral nine-mm. recessions of the lateral rectus muscles.

Ten days later, the cover test for distance re-

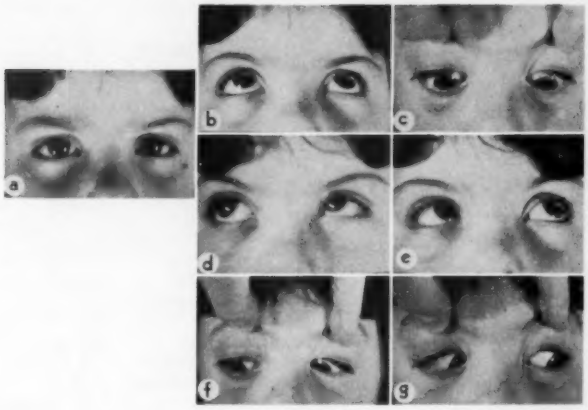

Fig. 9 (Villaseca). (Case 7.) Ten days after recession of both lateral recti. Orthophoria in the primary position (a) and downward gaze (c). Residual exotropia of 10 degrees looking up (b). Eyes level in the diagonal directions of gaze (d, e, f, g).

vealed a slight intermittent exotropia (of about 3.0 degrees) and the cover test for near a perfect orthophoria (fig. 9-a). A residual divergent strabismus of about 10 degrees (fig. 9-b) remained in the upward gaze and a perfect orthophoria (fig. 9-c) persisted in the downward gaze. The cover test in the oblique gazes did not disclose any vertical defect (fig. 9-d, e, f, g).

Cover measurements were: XT 12 Δ; XT' 12 Δ. Synoptophore: fixing O.U. = −8° R/L 2 Δ; fusion at this angle.

*Comment.* This patient had a typical V exotropia (25 to 30 degrees of manifest divergence looking up and perfect orthophoria looking down) without vertical deviations.

Since there was not the slightest spasm in the inferior obliques, the divergence of the visual axes in the upward gaze could only have been caused by a dysfunction of the horizontal rectus muscles in that gaze.

Recession of the lateral recti had an immediate asymmetrical result, since it corrected 15 to 20 degrees of deviation looking up, while leaving unchanged the pre-existent orthophoria in the downward gaze.

### B. "A" AND "V" SYNDROMES WITH SLIGHT VERTICAL DEVIATIONS

CASE 8

L. T., aged five and one-half years, had a history of convergent strabismus from the age of two years.

Examination revealed an alternating esotropia of about 25 degrees (fig. 10-a), which decreased to +7.0 degrees looking up (fig. 10-b) and increased to +40 degrees looking down (fig. 10-c). Study of the diagonal directions of gaze disclosed a slight spasm of the left inferior oblique (fig. 10-d).

Cover measurements were: ET 48 Δ, LH 6 Δ with O.D. fixing; ET 47 Δ Θ with O.S. fixing. Synoptophore: fixing O.D. = +33° L/R 4Δ; fix-

Fig. 10 (Villaseca). (Case 8.) V-esotropia, with slight spasm of the left inferior oblique (d): +25 degrees in the primary position (a), +7.0 degrees looking up (b) and +40 degrees looking down (c). Eyes level in e, f and g.

ing O.S. = +35° L/R 4 Δ. Abnormal retinal correspondence.

Refraction under atropine cycloplegia: O.D., +1.0D. sph. ⌒ +3.0D. cyl. ax. 90°; O.S., +4.0D. cyl. ax. 80°.

Simultaneous surgery on three horizontal muscles seemed to be indicated for this patient. It was clearly necessary to recess both medial recti, in view of the existence of a marked V syndrome (+7.0 degrees looking up and +40 degrees looking down). As the angle of deviation was considerable (cover measurements: 48 Δ; synoptophore: 34 arc degrees), and a deviation of about 7.0 degrees persisted in the upward gaze, it seemed advisable to do, in addition, a resection of one lateral rectus muscle.

It was, however, decided to proceed in two stages, and try to enhance the effect of surgery of the medial recti by simultaneously doing a recession and a marginal myotomy of these muscles.

At surgery, on October 2, 1959, bilateral five-mm. recessions and marginal myotomies of the medial rectus muscles were done. The myotomy was carried out after the recession had been completed, two thirds of the muscle width being first clamped by a hemostat (on each side of the muscle in turn) and then cut in order to produce a Z elongation of the muscle body.

Twenty days after surgery, the cover test for near showed a residual alternating esotropia of about 7.0 degrees, which decreased looking up to about 3.0 degrees and increased looking down to approximately 20 degrees. No vertical deviations could be perceived in the diagonal directions of gaze. The N.P.C. was unlimited. Glasses were prescribed: O.D., +2.5D. cyl. ax. 90°; O.S., −1.0D. sph. ⌒ +3.5D. cyl. ax. 80°.

The patient failed to return for follow-up visits and could not be located.

*Comment.* The case in question was a typical V esotropia (+7.0 degrees looking up and +40 degrees looking down), with only a slight spasm of the left inferior oblique. It would be hard to attribute such a big difference between the angle of deviation looking up and down to the secondary action of abduction of a slightly overacting inferior oblique muscle.

To increase the effect of surgery on the medial recti, recession and marginal myotomy of these muscles were undertaken experimentally at the same time. The immediate result of the operation was to correct 4.0 degrees of deviation in the upward gaze and 20 degrees of deviation in the downward gaze. A residual V strabismus remained (+3.0 degrees looking up and +20 degrees looking down), the subsequent evolution of which could not be followed since the patient unfortunately did not return for further check-ups.

An operation on three horizontal muscles simultaneously (recession of both medial recti and resection of one lateral rectus) would probably have been more effective in this case. In my opinion, surgery on the vertical muscles should not be undertaken in this patient, since there are no vertical deviations that would justify slackening these muscles.

CASE 9

S. I. presented an esotropia for the first time when convalescing from influenza at the age of nine years. In the beginning the strabismus was intermittent.

She was seen six weeks later, and a permanent right esotropia of 20 degrees was found, which showed no variation looking up or down. The study of ocular movements disclosed only a slight spasm of the left inferior oblique. Vision was 20/50 p., O.D.; 20/40 p., O.S. Synoptophore: fixing O.U. = +21° Θ. Simultaneous perception and fusion at +17° Θ. Glasses were prescribed (O.U., +2.5D. sph. ⌒ 0.75D. cyl. ax. 90°), and three hours daily occlusion of the left eye was ordered.

After two months, a right convergent strabismus of 15 degrees (with and without glasses) persisted. It did not vary in the downward gaze but looking up diminished to +5.0 degrees. A slight spasm of both inferior oblique muscles could be perceived at that time.

After four months with glasses, the patient showed an alternating strabismus of +20 degrees in the primary position (with and without glasses) which decreased to +5.0 degrees looking up and increased to +30 degrees looking down. This V syndrome was accompanied by a moderate spasm of both inferior obliques.

At surgery, on December 15, 1953, bilateral five-mm. recessions of the medial rectus muscles were done.

Three weeks after surgery, the cover test was negative in the primary position as well as in the upward and downward gazes (with and without glasses), and the spasm of the inferior obliques had disappeared. Synoptophore: fixing O.U. = +5° Θ c/c and +7° Θ s/c. Fusion at +5° Θ.

At the final check-up 18 months after the operation, the patient's eyes were straight in all directions of gaze.

*Comment.* After influenza, a comitant strabismus made a tardy appearance in this patient (at nine years of age).

At first the strabismus was the same in the

Fig. 11 (Villaseca). (Case 10.) A-esotropia, with moderate underaction of the right inferior oblique (f) and left inferior rectus (h): +30 degrees in the primary position (a, b), +30 degrees looking up (c) and 0 degrees looking down (d).

upward and downward gazes. Later, it acquired the characteristics of a V syndrome (+5.0 degrees looking up and +30 degrees looking down) with a moderate spasm of both inferior obliques.

Symmetrical surgery (recession of both medial recti) fully corrected the strabismus, that is, the 5.0-degree deviation existing in the upward gaze and the 30-degree deviation existing in the downward gaze (asymmetric effect); and by the same time (three weeks after surgery) the secondary spasm of the inferior obliques had entirely disappeared.

This case clearly demonstrates that the cause of the V esotropia is a dysfunction of the medial recti and that the spasm of the inferior obliques is secondary in nature.

CASE 10

M. B., aged five years, suffered from strabismus since the age of six months.

Examination revealed a 30-degree alternating esotropia (fig. 11-a, b), which did not vary looking up (fig. 11-c) and disappeared completely looking down (fig. 11-d). The study of ocular motility disclosed a moderate underaction of the right inferior oblique (fig. 11-f) and of the left inferior rectus muscle (fig. 11-h).

Vision was 20/40, O.D.; 20/30, O.S. Cover measurements were ET 50 Δ; ET' 50 Δ. Glasses were prescribed: O.U., +3.0D. sph.

Two months after starting to wear glasses the A esotropia was unchanged. Synoptophore: fixing O.D. = +30° L/R 9 Δ; fixing O.S. = +30° R/L 3 Δ (c/c). Abnormal retinal correspondence.

Since this was a typical case of A esotropia, it was decided to operate on the lateral rectus muscles.

At surgery, on October 16, 1959, an eight-mm. resection of the right and a 10-mm. resection of the left lateral rectus muscle were done.

As early as one week after the operation the A esotropia had apparently disappeared, since the patient's eyes seemed to be straight looking both up and down.

Forty days after surgery, the cover test for distance was negative with glasses and showed an alternating esotropia of about 5.0 degrees without glasses. The cover test for near revealed a residual esotropia of about 3.0 to 5.0 degrees c/c (fig. 12-a) and of about 7.0 degrees s/c (fig. 12-b). Looking up and down there was perfect orthophoria without glasses (fig. 12-c, d). The cover test in the diagonal directions showed that the underaction of the right inferior oblique had disappeared (fig. 12-f), a slight underaction of the left inferior rectus remaining (fig. 12-h).

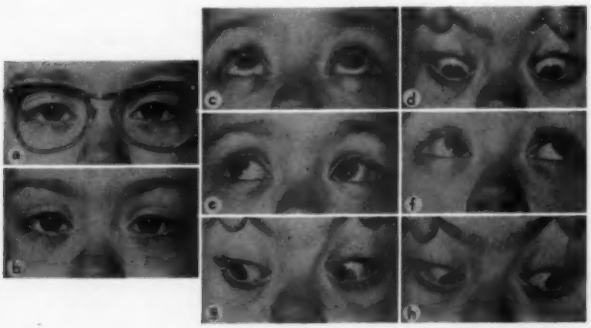

Fig. 12 (Villaseca). (Case 10.) Forty days after resection of both lateral recti. Residual esotropia of 3.0 to 5.0 degrees c/c (a) and 7.0 degrees s/c (b). Orthophoria looking up (c) and down (d). The underaction of the right inferior oblique has disappeared (f), and only a slight underaction of the left inferior rectus remains (h).

Cover measurements were: ET 10 Δ c/c and ET 15 Δ s/c; ET' 8 Δ c/c and ET' 20 Δ s/c. Synoptophore: fixing O.U. = +5° c/c and +10° s/c L/R 3 Δ. Intermittent fusion at +5° θ.

*Comment.* This patient had a typical A esotropia (30 degrees looking up and 0 degrees looking down), with moderate underaction of the right inferior oblique and left inferior rectus muscles.

The resection of both lateral recti corrected the A syndrome, since it produced the desired asymmetrical effect of removing the 30-degree deviation in the upward gaze and leaving unchanged the pre-existing orthophoria in the downward gaze.

The vertical defects diminished spontaneously after correction of the horizontal strabismus.

It was possible to corroborate in this patient that the A esotropia was due to an underaction of the lateral rectus muscles, since selective surgery of these muscles immediately corrected the syndrome.

CASE 11

M. R., aged one year, was brought for examination because of an intermittent divergent strabismus of the left eye. Her parents stated that the baby's maternal aunt and two great uncles all suffered from the same defect.

Examination revealed that the baby usually had her eyes straight, but that the left eye occasionally showed an exotropia of about 15 degrees.

She was seen again at three years of age, and at that time showed an intermittent alternating exotropia of about 15 degrees. In the upward gaze, a permanent alternating exotropia of approximately 20 degrees existed which disappeared in the downward gaze (V syndrome). The study of movement in the four diagonal directions of gaze did not reveal any vertical deviation. Synoptophore: fixing O.D = −19° L/R 7 Δ; fixing O.S. = −17° R/L 9 Δ. The child had a hypermetropia of 1.0D in O.U.

At four years of age she still showed an intermittent V exotropia (25 degrees permanent exotropia looking up and 5.0 degrees exophoria looking down), and at that time a slight spasm of both inferior obliques was also perceptible.

At the age of five years, the cover test for distance and near showed an intermittent alternating divergent strabismus of about 20 degrees. In the upward gaze, the manifest divergence had at this time increased to about 40 degrees, while on looking down there was only an exophoria of 5.0 degrees. A moderate spasm of the right inferior oblique and a slight spasm of the left inferior oblique were noted. Vision was 20/40, O.D.; 20/30, O.S. Cover measurement: XT 40 Δ. Synoptophore: fixing O.D. = −19° L/R 10 Δ; fixing O.S. = −18° R/L 14 Δ. Simultaneous perception and fusion at −18° θ.

At surgery, on April 24, 1957, bilateral nine-mm. recessions of the lateral rectus muscles were done.

One month later, the cover test for distance and near showed an intermittent residual exotropia of 5.0 degrees. The characteristics of a V syndrome were still apparent, since a manifest deviation of −15° existed in the upward gaze and the cover test was negative in the downward gaze. Synoptophore: fixing O.U. = −5° θ. Fusion at this angle.

Three months after surgery, the cover test was negative for both distance and near. Looking up, a deviation of only −5.0 degrees (alternating) was manifest, and looking down no deviation could be elicited. The spasm of the inferior obliques had entirely disappeared.

When last seen one year after surgery, the alternate cover test only disclosed a very slight exophoria (1.0 or 2.0 degrees) in the upward gaze. The cover test in the primary position (distance and near) and in the downward gaze was completely negative. No vertical deviations existed in the oblique gazes.

*Comment.* This was a typical case of intermittent divergent strabismus, with the characteristics of a V syndrome. In fact, preoperative examination showed a manifest exotropia of about 40 degrees in the upward gaze and only a exophoria (latent deviation) of about 5.0 degrees in the downward gaze.

Up to three years of age, study of the four diagonal directions of gaze failed to reveal any spasm of the inferior obliques, although a double hyperphoria was perceived at the synoptophore. From four to five years of age, a moderate spasm of the inferior obliques could be noted.

The symmetrical recession of both lateral recti definitely corrected the V exotropia (almost 40 degrees looking up and 5.0 degrees looking down). The secondary spasm of the inferior obliques also disappeared.

The asymmetrical result in the upward and downward gazes proves that surgery of the lateral rectus muscles is more effective in supraversion.

## C. "A" AND "V" SYNDROMES WITH MARKED VERTICAL DEVIATIONS WHICH IMPROVED AFTER SURGERY OF THE HORIZONTAL MUSCLES ONLY

CASE 12

This patient corresponds to Case 12 in my article on "Surgical classification of squints with a vertical

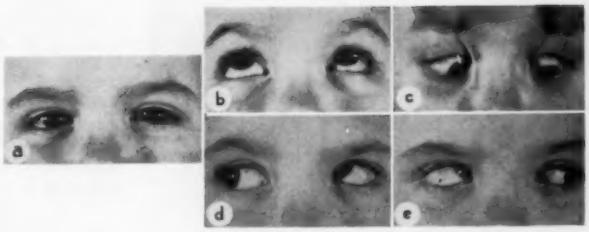


Fig. 13 (Villaseca). (Case 12.) V-esotropia with marked spasm of both inferior obliques (d, e): +20 degrees in the primary position (a), 0 degrees up (b) and +30 degrees looking down (c). (Reproduced by permission of the *Brit. J. Ophth.*, **39**: 142, 1955.)

deviation,"[7] and the photographs have been reproduced here by permission of the *British Journal of Ophthalmology*.

M. C., aged five years, presented with a convergent squint of the right eye from the age of eight months. She wore glasses of +5.0D. sph., O.U. Examination showed a right esotropia of about 15 degrees with glasses and of about 20 degrees without glasses, with marked amblyopia ex anopsia (1/40), frank paresis of the left superior rectus and spasm of the right inferior oblique (amblyopic eye). There was no noticeable spasm of the left inferior oblique. After occlusion of the left eye for two months, vision increased in the right eye to 5/50, and a marked spasm was then evident in both inferior obliques. Five months after occlusion the visual progress stopped at 5/30. The patient presented all the characteristics of Urist's Group 1. In fact the esotropia of about 20 degrees in the primary position (fig. 13-a) disappeared in the upward gaze (negative cover test) (fig. 13-b) and increased to +30 degrees in the downward gaze (fig. 13-c), and a marked spasm of both inferior obliques was evident (fig. 13-d, e).

At surgery, on March 4, 1953, bilateral five-mm. recessions of the medial rectus muscles were done.

A month later, the cover test was negative in the primary position (fig. 14-a), a slight exotropia could be noted in the upward gaze (fig. 14-b) and a slight esotropia looking down (fig. 14-c). A decrease in the spasm of the inferior obliques could be noted (fig. 14-d, e). Three months after surgery, there was no elevation in adduction (fig. 15-a, b). In supralevoversion, a slight spasm of the right inferior oblique could still be demonstrated.

When last seen six years after the operation, the cover test for distance and near (with and without glasses) was negative. Orthophoria also existed in the straight-up and straight-down positions of gaze (fig. 16-b, c). Only a slight spasm of the right inferior oblique remained (fig. 16-e). Vision was 20/160, O.D.; 20/20, O.S. Synoptophore: fixing O.D. = +8° θ; fixing O.S. = +5° R/L 3 Δ. Fusion at 0° only with the large pictures, and suppression of O.D. with the macular slides.

*Comment.* This patient had a typical V esotropia (0 degrees looking up and +30 degrees looking down). Only the spasm of the inferior oblique in the nonfixing (amblyopic) eye was apparent at the start; this might have led to the error of classifying the case as a primary vertical squint (paresis of the contralateral superior rectus). Prolonged occlusion brought to light a spasm of the inferior oblique in the fixing (occluded) eye as well, and allowed for a correct classification (Urist's Group 1).

Symmetrical surgery (recession of both medial recti) yielded a frankly asymmetrical result, since it led to orthophoria in both the upward gaze (0 degrees preoperative deviation) and the downward gaze (30 degrees preoperative deviation). The secondary spasm of the inferior obliques also improved.

The long period (from eight months to five years of age) during which the patient endured a permanent strabismus in her right eye without any treatment left, however, sensorial and muscular sequelae. The sensorial sequela was the partially irrecoverable amblyopia ex anopsia, and the muscular sequela the slight persistent contracture of the inferior oblique in the amblyopic eye. In fact, the part that was still reversible in the overaction of the right inferior oblique

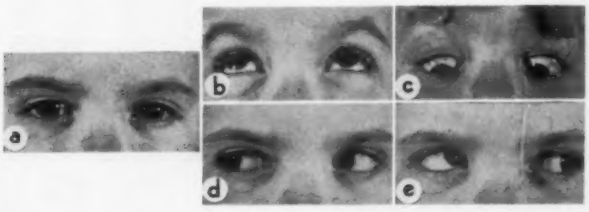


Fig. 14 (Villaseca). (Case 12.) One month after recession of both medial recti, showing decrease in the secondary spasm of the inferior obliques (d, e). Cover test negative in the primary position (a), slight exotropia looking up (b) and slight esotropia looking down (c). (Reproduced by permission of the *Brit. J. Ophth.* **39**: 143, 1955.)

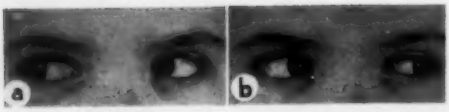

Fig. 15 (Villaseca). (Case 12.) Three months after surgery, showing that elevation in adduction has disappeared (a, b). (Reproduced by permission of the *Brit. J. Ophth.* **39**: 143, 1955.)

was relaxed by the recession of the homolateral medial rectus (as shown by the patent reduction of the strong spasm in the inferior oblique), the only residue being a slight irreversible overaction due to the muscular contracture added to the spasm.

This case exemplifies, the mechanism, which was described earlier* in this paper, by which the synkinetic overaction of the inferior obliques (a reversible functional spasm) can degenerate after a certain time into an irreversible contracture, thereby giving rise to a mixed case (Group C in my classification).

CASE 13

S. G. had a history of convergent strabismus since she was two years of age. She was treated with glasses (O.U., +3.5D. sph. ⊃ +0.75D. cyl. ax. 90°) and occlusion.

At five years of age, the patient was referred to me by her ophthalmologist, Dr. Guillermo O'Reilly. Examination revealed a right convergent esotropia of about 10 degrees with glasses and 15 degrees without glasses. The strabismus increased to about 20 degrees in looking up and disappeared completely in the downward gaze (A esotropia). A moderate underaction of both inferior obliques was present. Vision was 20/80, O.D.; 20/30, O.S., c/c. Synoptophore: fixing O.U. = +10° θ c/c and +19° θ s/c.

In December 1953, Dr. O'Reilly performed bilateral resections of the lateral rectus muscles.

I examined the child again 18 months after surgery, at which time the cover test could detect only a very slight right esotropia (2.0 or 3.0 degrees) (with and without glasses). This very small deviation did not vary in either the straight-up or straight-down positions of gaze. The underaction of the inferior oblique muscles had completely disappeared. Synoptophore: fixing O.D. = +3° θ; fixing O.S. = +3° R/L 2 △ (c/c).

A year later, the patient showed a slight right esotropia (about 5.0 degrees with and without glasses), which did not vary looking up or down, and a moderate spasm of the right inferior oblique.

When last seen five and one-half years after the operation, the cover test showed a barely perceptible right esotropia (1.0 or 2.0 degrees), which did not vary in the upward or downward gazes. Vision was 20/80, O.D.; 20/30 p., O.S., (c/c). A moderate spasm of the inferior oblique existed in the amblyopic (right) eye.

*Comment.* This patient had a typical A esotropia (+20 degrees looking up and 0 degrees looking down) with underaction of both inferior obliques.

This A syndrome was corrected by the resection of both lateral recti, thus proving again that operations on these muscles have a greater effect on the upward gaze. The underaction of the inferior obliques not only disappeared but a slight spasm (the opposite defect) of the inferior oblique in the amblyopic eye subsequently developed, thereby corroborating the secondary nature of the vertical deviations.

### D. TARDY APPEARANCE OF VERTICAL DEVIATIONS IN PATIENTS WITH HORIZONTAL STRABISMUS

Even authors who claim that the A and V syndromes are caused by primary bilateral vertical defects acknowledge that they have witnessed the tardy appearance of vertical

Fig. 16 (Villaseca). (Case 12.) Six years after surgery. Orthophoria in primary position (a), looking up (b) and looking down (c). Slight residual spasm of the right inferior oblique (e).

* See page 174, paragraph 6.

deviations in cases of horizontal strabismus. Urrets-Zavalía[9] states that he has seen secondary vertical deviations appear, usually in the form of a moderate upshooting of the adducted eye "in cases of a purely accommodative, permanent esotropia in which a previously non-existent vertical component appeared after some months or years."

An example of the late appearance of a moderate spasm of the inferior obliques in a patient with intermittent exotropia has already been described (Case 11).

The following case illustrates the tardy appearance of marked vertical deviations in a convergent strabismus, and their subsequent disappearance after an operation on the horizontal muscles confirmed the secondary nature of such deviations.

CASE 14

M. H., aged three years, was brought for treatment three months after the right eye had begun to squint.

Examination revealed a convergent strabismus of about 15 degrees for distance and near, usually of the right eye but with some tendency to alternate. Since the angle of deviation did not vary looking up or down, and no vertical defects could be observed in the four diagonal directions of gaze, the case was classified as a *simple* strabismus. Synoptophore: fixing O.U. = +25° Θ. Glasses were prescribed (O.U., +3.5D. sph.), and half-day occlusion of the left eye was ordered.

The course of the strabismus in this patient was interesting. Six weeks after beginning to wear glasses he showed with the cover test for near an esophoria of about 5.0 degrees c/c and an intermittent strabismus of about 15 degrees s/c. There was only a slight variation in the angle of deviation s/c when looking up (+10 degrees) and down (+15 degrees).

Two and a half months later, the cover test for distance showed a very slight right esotropia (about 3.0 degrees) with glasses, which increased to approximately 7.0 degrees without glasses. The cover test for near was negative with glasses, and an esotropia of about 7.0 degrees existed without glasses. Looking down, the angle of strabismus did not vary (+7.0 degrees), and looking up, it decreased to about +3.0 degrees (s/c). Synoptophore: fixing O.U. = +7° c/c and +9° s/c. He was unable to understand the subjective examination.

Four months later, the conditions were unchanged, and the study of the four diagonal directions of gaze again failed to detect any vertical deviation.

At a check-up five months later (one year after the first examination), some new developments could be observed. A permanent alternating esotropia for both distance and near existed of about 5.0 degrees c/c and 10 degrees s/c. A-V syndrome was now certain since without glasses the strabismus decreased to +5.0 degrees in the upward gaze and increased to +15 degrees looking down. A moderate spasm of both inferior obliques had appeared. This deterioration in the course of the patient's strabismus had occurred although he had been wearing his glasses constantly.

When seen again seven months later he had an alternating esotropia of 10 degrees (with glasses) for distance and near. Without glasses the deviation for near was 25 degrees in the primary position, 15 degrees looking up and 30 degrees looking down. A marked spasm of both inferior oblique muscles and a frank underaction of the superior obliques were now evident. If the patient had been seen for the first time at this moment, I would certainly have thought, in view of the powerful spasm in the inferior obliques and frank underaction of both superior obliques, that a primary bilateral vertical deviation existed. Synoptophore: fixing O.D. = +19° L/R 7 △; fixing O.S. = +19° L/R 5 △. There was abnormal retinal correspondence.

A month later, the same degree of deviation persisted in the primary position. In the extreme upward gaze the strabismus was seen to disappear (alternate cover test s/c = 0 degrees), while in the downward gaze it increased to +35 degrees (a typical V esotropia). The marked spasm of the inferior oblique muscles persisted.

As the vertical deviations made their appearance one year after the patient's first examination and had had a duration of less than nine months, it was decided to operate on the medial rectus muscles alone in the hope that an irreversible contracture of the inferior obliques had not yet occurred.

At surgery, on December 10, 1958, bilateral five-mm. recessions of the medial rectus muscles were done.

A month after surgery, the cover test for distance and near was negative with glasses, and showed 5.0 degrees of esotropia without glasses. Looking up, the eyes were straight without glasses, and looking down only a slight esotropia existed (2.0 or 3.0 degrees). The deviation without glasses was thus a little bigger in the primary position than in the downward gaze. The cover test in the oblique gazes was highly gratifying since it demonstrated that the spasm of the right inferior oblique had completely disappeared and that only a very slight spasm of the left inferior oblique remained, although only a month had elapsed since the operation on the medial recti. Synoptophore: fixing O.U. = +2° Θ. Fusion at 0° Θ.

Four months after surgery, there was orthophoria with and without glasses in all directions of gaze. No trace of the vertical deviations could be found in the oblique gazes. Synoptophore: 0° Θ, c/c and s/c. Fusion and stereopsis. The strength of the glasses was reduced to +2.25D. sph., O.U.

At the final check-up nine months after surgery,

vision in both eyes was 20/20 p., c/c, and orthophoria persisted in all directions of gaze. Synoptophore: 0° Θ, c/c and s/c.

*Comment.* I was able to witness in this patient the gradual transformation of a "simple" convergent strabismus (same deviation looking up and down; no vertical defects) into a V syndrome, and the tardy appearance (one year after the first examination) of a progressive spasm of the inferior obliques. This spasm became very intense and was also accompanied by frank underaction of both superior obliques, so that it seemed quite impossible for it to disappear without an operation on those muscles.

Fortunately I decided to perform surgery on the medial rectus muscles only, and to attack the inferior obliques at a (probable) second operation. Recessions of both medial recti were immediately effective in correcting the V esotropia (0 degrees in the upward gaze and +35 degrees in the downward gaze) and in making the spasm of the inferior obliques rapidly dwindle away.

The successive appearance and disappearance of the spasm in the inferior obliques during the course of this patient's esotropia are clear proof of the secondary nature of the vertical deviations.

### E. Postoperative A and V syndromes

I refer here to cases of strabismus which were originally comitant in the straight-up and straight-down positions of gaze and, after a recession-resection operation, were left with a residual strabismus possessing the characteristics of an A or V syndrome. This is of great practical importance when a decision has to be made on the type of operation to be performed, should a second intervention be required.

For instance, if, after a recession-resection operation for a "simple" convergent strabismus of about 25 degrees (no variation looking up and down), a residual esotropia of about 10 degrees persists in the straight ahead and downward gazes which disappears on looking up (V syndrome), the indicated operation would be a recession of the medial rectus muscle of the unoperated eye. If, on the other hand, this same residual strabismus of 10 degrees in the primary position does not vary in the upward gaze but disappears on looking down (A syndrome), a resection of the lateral rectus muscle of the unoperated eye would be called for. If, in the second example, a recession of the medial rectus is mistakenly performed instead of the indicated resection of the lateral rectus (A esotropia), overcorrection would undoubtedly result.

In the case of these patients with postoperative A or V syndromes, a fairly long time should be allowed to elapse (six months to a year) before a second operation is embarked upon. Particular caution has to be exercised with V residual esotropias, since the spasm of the medial rectus in the unoperated eye may gradually decrease in one or more years. If both vision and fusion are good, there is no need to hasten reoperation.

Overcorrections with the characteristics of A or V syndromes may also be observed after recession-resection operations on patients with "simple" (same degree looking up and down) convergent strabismus. If the postoperative divergent squint is greater on looking up (V exotropia), a recession of the previously resected lateral rectus muscle should be done. If, on the other hand, the postoperative exotropia disappears in the upward and is accentuated in the downward gaze (A exotropia), the proper surgery would be an advancement (or resection) of the previously recessed medial rectus.

Urist's assertion that surgery of the medial rectus is more effective in the downward gaze and surgery of the lateral rectus more effective in the upward gaze has therefore an excellent field for application in postoperative strabismus, whether the case is one of under- or overcorrection.

The emergence of A and V syndromes after surgery on the horizontal muscles in squints that were previously comitant in the

upward and downward gazes provides almost experimental proof that these syndromes are due to a derangement of the horizontal muscles only.

The following case is a typical example of postoperative A esotropia.

CASE 15

F. L. developed an alternating convergent strabismus at the age of four months. He was first seen when he was 10 months old at which time he presented an alternating esotropia of about 20 degrees. Alternate occlusion was prescribed.

At one and one-half years of age, he usually fixed with the right eye, in spite of having strictly adhered to the treatment of alternate occlusion. A 30-degree convergent strabismus with moderate limitation of abduction in the left eye was noted. The diagnosis was therefore paresis of the left lateral rectus muscle.

At three years of age, glasses were prescribed (+3.0D. sph., O.U.). After six months with glasses, the child showed an alternating esotropia of about 25 degrees c/c. The strabismus did not vary in the straight-up or straight-down gazes. The study of versions in the four diagonal directions of gaze failed to reveal any vertical deviation. Synoptophore: fixing O.U. = +36° Θ c/c and 40° Θ s/c.

At surgery, on June 3, 1957, a five-mm. recession of the left medial rectus and a nine-mm. resection of the left lateral rectus muscle were done.

Three months after surgery, a residual alternating esotropia of about 15 degrees (with and without glasses) existed, that did not vary in the upward gaze (+15 degrees) but disappeared looking down (A syndrome). No vertical deviations could be observed in the oblique gazes.

Five and a half months after surgery, the residual strabismus of about 15 degrees with the familiar characteristics of an A esotropia (15 degrees looking up and 0 degrees looking down) persisted. Cover measurements with glasses were: ET 25 Δ; ET' 20 Δ. Synoptophore: fixing O.U. = +18° R/L 6 Δ c/c. Vision was: O.D., 20/40; O.S., 20/60.

At a second operation, on December 9, 1957, an eight-mm. resection of the right lateral rectus muscle was done.

Twenty days after surgery, the patient was usually orthophoric with glasses. Without glasses, a permanent esotropia of 5.0 degrees existed in the primary position, which did not vary in the upward gaze but disappeared on looking down. Synotophore: fixing O.U. = +10° Θ c/c and +12° Θ s/c. Fusion at +9° Θ.

When last seen, 18 months after the second operation, the patient's eyes were straight with glasses and showed a slight esotropia of about 5.0 degrees without glasses. The angle was the same in the straight-up and straight-down positions of gaze, and no vertical deviations existed. Vision, O.U., was 20/30. Synoptophore: fixing O.D. = 0° Θ; fixing O.S. = +7° Θ. Fusion at +2° with the large pictures and alternate suppression with the smaller (macular) slides.

*Comment.* This child had a marked esotropia (30 degrees) since the age of four months. Examinations up to three years of age showed that the esotropia was the same in the upward and downward gazes and that no vertical deviations existed.

After a recession-resection operation on the left eye, a residual strabismus of +15 degrees remained in both the primary position and straight-up gaze, but the deviation disappeared in the downward gaze (postoperative A esotropia).

Resection of the right lateral rectus muscle at a subsequent operation corrected the residual A syndrome, which was therefore due to an underaction of this muscle.

### F. MIXED CASES

The mere law of probabilities will lead to the combination, in certain patients, of genuine A and V syndromes (caused by dysfunction of the respective horizontal muscles) with *primary* unilateral or bilateral vertical deviations.

For instance, a child may originally have a paresis of one superior oblique muscle (or both). Once binocular vision has been disrupted (by the vertical imbalance of the eyes), a V esotropia may easily be added in a hypermetropic child owing to prolonged unrestrained overaction of the medial rectus muscles. In such a case, the recession of the contractured medial recti will of course correct only the horizontal defect. The vertical primary deviation will have to be attacked either at the same time as the horizontal deviation or at a second operation. An example of a mixed case of this type will be given below.

It has already been pointed out that a mixed case can also be produced by the addition of a secondary irreversible contracture of the inferior obliques to a V syndrome that was originally pure (Case 12), and in which the spasm of the inferior obliques that

Fig. 17 (Villaseca). (Case 16.) Mixed case: V-esotropia combined with a primary paresis of both superior recti. Although the fixing eye is the left (a), the spasm of the inferior oblique in this eye (b) is greater than that of the inferior oblique in the amblyopic eye (c). (Reproduced by permission of the *Brit. J. Ophth.*, **39**: 148, 1955.)

was first functional (reversible) has persisted for too long a time.

CASE 16

This patient corresponds to Case 16 in my article on "Surgical classification of squints with a vertical deviation,"[7] and the photographs are reproduced here by permission of the *British Journal of Ophthalmology*.

E. P., aged five years, presented a right convergent squint since birth. He had been submitted to periodic occlusion of the left eye since the age of one year. After a period of alternate occlusion, examination revealed a convergent squint of about 20 degrees in the primary position (fig. 17-a), 5.0 degrees looking up and 30 degrees looking down (V syndrome). There was a marked spasm of the left inferior oblique (fig. 17-b) and a moderate spasm of the right inferior oblique (fig. 17-c). Vision was 20/80 in the right eye and 20/50 in the left eye. It should be noted that the fixing eye showed the greater spasm in the inferior oblique muscle. Synoptophore: fixing O.D. = +30° L/R 14 △; fixing O.S. = +30° θ.

At surgery, on January 7, 1953, bilateral five-mm. recessions of the medial rectus muscles were done.

Six months after surgery, a residual convergent squint of about 15 degrees remained in both the primary position (fig. 18-a) and on looking down. When looking up, there was no horizontal deviation. A marked spasm persisted in the left inferior oblique (fig. 18-b) and a slight one in the right inferior oblique (fig. 18-c), but they were less marked than before the recessions of both medial recti.

An unequal paresis of both superior recti was diagnosed.

At a second operation, on July 1, 1953, a 10 mm. resection of the right lateral rectus, myectomy of the left inferior oblique and marginal myotomy of the right inferior oblique muscles were done

The result can be seen in Fig. 19-a, b and c; nine months after the second operation the cover test was negative when looking forward, up and down, and all versions were normal. Synoptophore: fixing O.D. = +4° L/R 14 △; fixing O.S. = +4° R/L 2 △. Intermittent fusion; at times the right eye suppressed.

Fig. 18 (Villaseca). (Case 16.) Six months after recession of both medial recti. Residual esotropia of 15 degrees (a). Decrease in the spasm of the inferior obliques (b, c). (Reproduced by permission of the *Brit. J. Ophth.* **39**: 149, 1955.)

*Comment.* This patient had a V esotropia (5.0 degrees looking up and 30 degrees looking down) with a greater spasm of the inferior oblique in the fixing than in the amblyopic eye. This seemed to indicate a mixed case, with an unequal primary paresis of both superior recti combined with a genuine V syndrome.

Recessions of both medial rectus muscles left a residual V esotropia and diminished the spasm in the inferior obliques. Thus only part of the spasm could be considered as secondary. The existence of primary bilateral vertical deviations was therefore confirmed.

Myectomy of the inferior obliques and resection of the right lateral rectus muscle were successful in producing orthophoria in all directions of gaze.

This case was finally classified as a primary vertical strabismus of Group 3 in my classification (bilateral paresis or spasm of twin muscles), combined with esotropia with bilateral elevation in adduction (Urist's Group 1: V esotropia).

## PRACTICAL APPLICATIONS

### SYMMETRICAL VERSUS ASYMMETRICAL SURGERY

A proper understanding of the mechanism that produces the A and V syndromes is essential for the surgical treatment of strabismus.

Fig. 19 (Villaseca). (Case 16.) After resection of the right lateral rectus, myectomy of the left inferior oblique and marginal myotomy of the right inferior oblique muscles. Orthophoria (a), and eyes level in the diagonal directions of gaze (b, c). (Reproduced by permission of the *Brit. J. Ophth.*, **39**: 149, 1955.)

In the preceding pages, I have demonstrated that these syndromes are caused by dysfunctions of the horizontal muscles. In fact, I have shown typical cases of A and V syndromes which had no vertical deviations in the four diagonal directions of gaze (Cases 1, 2, 3, 4, 5, 6 and 7). Vertical deviations are therefore an inconstant (although frequent) symptom of these syndromes, but they are not their cause. The correction of the different angles of deviation in the straight forward, upward and downward gazes by means of the appropriate surgery on the horizontal muscles only (Cases 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15) is proof that these muscles have a pathogenic action in the production of the A and V syndromes.

The whole range of "secondary" vertical deviations may be observed in the A and V syndromes. I have shown patients *without* such deviations (Cases 1, 2, 3, 4, 5, 6 and 7), others with *slight* deviations (Cases 8, 9, 10 and 11) and others again with *marked* deviations (Cases 12, 13 and 14). The elimination of marked vertical deviations by an operation on the horizontal muscles only (Cases 12, 13 and 14) testifies to the secondary nature of these defects.

The tardy appearance of vertical deviations in patients with horizontal strabismus (Case 14) also confirms that such deviations are secondary. Moreover, it was possible to note in this patient the complete disappearance of the strong spasm of the inferior obliques (which had appeared one year after the onset of the esotropia) as the immediate result of recession of the medial rectus muscles.

Finally, the appearance of previously nonexistent A and V syndromes after surgery of some horizontal muscles constitutes an almost experimental demonstration. Case 15 had a convergent strabismus which was originally comitant in the straight-up (+30 degrees) and straight-down (+30 degrees) gazes, without vertical deviations. A recession-resection operation in O.S. left a residual strabismus of +15 degrees in both the primary position and straight-up gaze, which disappeared in the downward gaze (postoperative A esotropia). This was corrected at a second operation by resection of the right lateral rectus muscle.

On the other hand, attention is drawn to the existence of mixed cases, in which, in a given patient, primary unilateral or bilateral vertical deviations are combined, by pure chance, with a horizontal strabismus of the A or V type (Case 16).

In V syndromes, the appropriate surgical treatment is symmetrical recession of both medial rectus muscles in cases of esotropia (Cases 2, 3, 8, 9, 12 and 14) and of both lateral rectus muscles in cases of exotropia (Cases 7 and 11). In A esotropias, the proper surgery is resection of both lateral rectus muscles (Cases 6, 10 and 13).

According to Urist's ideas, resection of both medial recti would be the operation of choice for A exotropias. I have had no experience with this fourth group, which seems to be quite rare. Jampolsky,[10] in a carefully selected group of children with A exotropias, who had little horizontal deviation in the primary position and good fusion and marked bilateral overaction of the superior oblique muscles, obtained a correction of the exodeviation in the downward gaze by means of bilateral superior oblique tenotomy.

I should like to draw special attention to the asymmetrical result of symmetrical surgery in the upward and downward gazes, as may be seen in Tables 1, 2 and 3.

The first and most obvious conclusion to be drawn from an analysis of these tables is that symmetrical surgery is specifically indicated for the A and V syndromes. The second conclusion is that, although symmetrical surgery produces symmetrical results in so far as the degree of deviation corrected in the lateroversions is concerned, it does not give symmetrical results in the supra- and infraversions.

It therefore seems to me that symmetrical surgery should not be performed on the majority of patients with strabismus that is

TABLE 1

ARC DEGREES CORRECTED BY RECESSIONS OF BOTH MEDIAL RECTI

| Case | Upward Gaze | Downward Gaze |
|---|---|---|
| 2 | 3° | 15° |
| 3 | 7° | 20° |
| 9 | 5° | 30° |
| 12* | 0° | 30° |
| 14* | 0° | 35° |
| 16 | 5° | 15° |

* Cases 12 and 14 are specially illustrative, since the recessions of the medial rectus muscles had no effect on the upward gaze (the pre-operative orthophoria remaining unmodified), whereas it corrected 30 and 35 arc degree deviations in the downward gaze.

comitant in the straight-up and straight-down positions of gaze. I usually perform asymmetrical surgery (recession-resection) in these cases and have found that it gives excellent results.

Admittedly, asymmetrical surgery often gives asymmetrical results in the lateroversions. This is why I have limited the amount of resection of the lateral rectus muscle in cases of esotropia to a maximum of eight mm., thus obtaining less asymmetry. In any case, it seems to me more important to achieve a symmetrical result in the supra- and infraversions since these gazes are habitually used in daily life, the extreme right and left gazes being less commonly used as one normally turns the head in order to look sideways.

With regard to the "fashion" for symmetrical surgery in any type of strabismus, I recall having attended in 1955 a check-up of a group of patients on whom recessions of both medial rectus muscles had been done as routine procedure for esotropia. The majority were either under- or overcorrected. The straight-up and straight-down gazes had not been studied preoperatively, since only the four diagonal directions of gazes were considered important. The few patients who came that day for their regular check-up and who had had a recession-resection operation in the past (before the new era of symmetrical surgery) were, by contrast, perfectly straight.

For surgical purposes, I classify cases of horizontal strabismus in two distinct groups: (a) simple strabismus; and (b) A and V syndromes.

Those cases which show no appreciable difference between the angle of deviation in the straight-up and straight-down positions of gaze have been called "simple" (convergent or divergent) strabismus. These constitute over 60 percent of all cases of squint. Asymmetrical surgery (recession-resection operation) gives the best results in this group of patients.

Conversely, symmetrical surgery is definitely indicated in cases of A and V syndromes. In this respect, it should be remembered that, as Urist has pointed out, surgery of the medial rectus muscles has more effect on the downward gaze (Cases 2, 3, 8, 9, 12, 14 and 16) while operations on the lateral recti primarily influence the upward gaze (Cases 6, 7, 10, 11 and 13).

In cases of A and V syndromes in which the strabismus disappears completely or almost disappears in either the upward or downward gaze, a perfect result is usually (though not always) achieved by a one-stage

TABLE 2

ARC DEGREES CORRECTED BY RESECTIONS* OF BOTH LATERAL RECTI

| Case | Upward Gaze | Downward Gaze |
|---|---|---|
| 6 | 13° | 3° |
| 10 | 30° | 0° |
| 13 | 18° | 0° |

* It is noteworthy that this operation had virtually no corrective effect on the angle of deviation that existed in the downward gaze.

TABLE 3

ARC DEGREES CORRECTED BY RECESSIONS* OF BOTH LATERAL RECTI

| Case | Upward Gaze | Downward Gaze |
|---|---|---|
| 7 | 17° | 0° |
| 11 | 38° | 5° |

* The selective effect of this operation on the existing deviation in the upward gaze is clearly apparent.

symmetrical operation. Conversely, if 10 or more arc degrees of deviation exist in the position of gaze in which the strabismus is least mark (for example, +15 degrees looking up and +35 degrees looking down), an operation will usually have to be performed on three muscles. In this example, recessions of both medial recti would correct the difference (20 degrees) between the angle of deviation looking up and down, but in order to eliminate the 15-degree deviation existing in the upward gaze a resection of one lateral rectus muscle would usually be called for as well. If, however, the patient in this example is markedly hypermetropic, very young, has an amblyopic eye or shows persistent suppression, it would be better to attack the medial rectus muscles only, and keep the patient under observation for a year or two until it can be decided whether a second operation on a lateral rectus muscle is advisable.

In strabismus operations, the amount of surgery (in mm.) that I do on each muscle is nearly always the same, that is, a five-mm. recession of the medial rectus, eight-mm. resection of the lateral rectus, nine-mm. recession of the lateral rectus and 10-mm. resection of the medial rectus. The choice of the muscles to be operated depends on the criteria which have been described previously; in short, asymmetrical surgery in the case of a "simple" strabismus and symmetrical surgery in the case of A and V syndromes. I consider that symmetrical recessions should also be done, in spite of the existence of comitance in the upward and downward gazes, in cases of intermittent exotropia and in patients with a slight degree of esotropia (provided that the N.P.C. is normal) or with esotropias that are mostly accommodative.

In the lengthening operations for the V syndromes I believe that it is particularly important to perform full recessions as just mentioned (five mm. for the medial rectus muscle in esotropia and nine mm. for the lateral rectus in exotropia). Both threads of each suture are inserted in a mattress fashion in the sclera at the above-mentioned distances from the insertion. In this way the muscle tendon comes to a stop at the point of entry and not at the point of exit of the suture, which is one mm. further forward in the sclera. The new insertion in the sclera is left narrower than usual (about six-mm. wide) in order to compensate for the reduction of the width of the muscle produced by the whiplock sutures. The scleral bites for the retroinsertion of the muscle must be displaced medially by two mm. for both lateral threads in the whiplock sutures, thus achieving a symmetrical reduction that will avoid a vertical deviation. It is of the utmost importance to cut all the check ligaments as far back as possible and also to loosen the intermuscular membranes, so as to recess into the orbit not only the head of the muscle but its whole body, thus obtaining a complete relaxation. A recession operation for the V syndromes may be quite ineffectual if these directions are not fully followed.

In small angle deviations of the A and V type (for example, a V esotropia of 5.0 degrees in primary position, 0 degrees looking up and 7.0 degrees looking down), a one-muscle operation will be done (a recession of one medial rectus in this instance), but the amount in mm. (five mm.) will not vary. That is to say, full recessions in the V syndromes and full resections in the A syndromes are always done, sometimes limited to one muscle but habitually dealing with both muscles, thus performing symmetrical surgery, as already mentioned.

It is not always easy to decide whether the vertical muscles should be operated on as well. If the degree of horizontal deviation varies markedly between the straight-up and straight-down positions of gaze (A and V syndromes), the vertical deviations are probably secondary in nature and surgery should be limited to the horizontal muscles only (Cases 8, 9, 10, 11, 12, 13 and 14). However, if, after the horizontal strabismus has been corrected, the vertical deviations

persist during a long observation period, it means that either an irreversible contracture of the vertical muscles has already been produced (through prolonged functional spasm) as in Case 12, or that we were dealing with a mixed case from the start (A or V syndrome combined with primary vertical paresis—Case 16).

In the A and V syndromes, the secondary vertical deviation is usually greater in the amblyopic eye, and may even appear at the outset in the form of a unilateral defect (Case 12). If the vertical deviation is more marked in the fixing eye, the case is a mixed one (Case 16).

In cases of "simple" strabismus, which show no appreciable difference between the angle of deviation in supra- and infraversions, the coexisting vertical deviations should be considered as primary. In this case, both the vertical and horizontal deviations should be attacked at the same sitting, since the latter was probably induced after the binocular vision had been disrupted by the initial vertical defect.

## Summary

Regarding the mechanism that causes the A and V syndromes two opposing schools of thought exist: (1) primary bilateral vertical defects operating through the secondary action of abduction or adduction of the affected vertical muscles; (2) primary dysfunction of the horizontal muscles, the coexisting bilateral vertical deviations being of a secondary nature.

As evidence in favor of the second mechanism, case reports are presented in this paper showing: (a) A and V syndromes *without* vertical deviations; (b) A and V syndromes with slight vertical deviations; (c) A and V syndromes with marked vertical deviations that were eliminated after surgery of the horizontal muscles only; (d) tardy appearance of vertical deviations in patients with horizontal strabismus; (e) postoperative A and V syndromes, that appeared after surgery of the horizontal muscles in strabismus which were originally comitant in the straight-up and straight-down gazes.

On the other hand, mixed cases do exist, in which, in a given patient, primary unilateral or bilateral vertical deviations are combined, by pure chance, with a horizontal strabismus of the A or V type.

The indications for symmetrical and asymmetrical surgery in strabismus are discussed. My case reports show that symmetrical surgery gives frankly asymmetrical results in supra- and infraversions, and is therefore specifically indicated for the A and V syndromes. Conversely, in "simple" horizontal strabismus (same degree of deviation looking up and down) asymmetrical surgery gives the best results.

*Marcel Duhaut 2959.*

### Addendum

This article does not cover the literature that appeared during 1959-1960, since it was written in 1959.

I have not tried the new approach of displacing the insertion of the horizontal muscles upward or downward, or of the vertical recti inward or outward. Since horizontal surgery has usually given good results in my patients, I would dislike altering the normal anatomy of muscles that do not show an anomalous insertion.

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# EXPERIENCE IN 812 CATARACT OPERATIONS WITH ENZYMATIC ZONULOLYSIS*

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Since the first application of alpha chymotrypsin in the surgery of the eye in May, 1958, up to the end of March, 1960, we have operated in the Athens University Eye Clinic, with the help of this enzyme, 812 cataracts of which 633 were senile and presenile, 82 pathologic, 27 myopic, 33 traumatic and 37 congenital.

The technique which we use is the following: Preanesthesia varying according to the docility of the patient. Local anaesthesia with Novocaine plus hyaluronidase in order to obtain good immobility and at the same time a hypotonic globe. Endotracheal anesthesia in children. The simultaneous use of curare produces a complete relaxation of the striated muscular fibers.

The corneal section is made with a Graefe knife and is enlarged with scissors, in order to obtain an extension of 170 degrees. Then, six sclerocorneal 6-0 sutures are placed. The space under the iris is irrigated with 1.0 cc. up to 1.5 cc. of a solution (1:5,000) of the enzyme over the whole length of the equator of the lens, in order to obtain uniform dissolution of the zonule. A peripheral iridectomy—or two on agitated patients—is carried out. After one or two minutes (three or four minutes in children) the lens is grasped and extracted by forceps or by the erisophake.

The anterior chamber is then irrigated with 1.0 to 1.5 cc. of a solution of diluted acetylcholine (10 drops of 2.0-percent solution diluted in 1.0 cc. of a penicillin solution). Fast myosis is thus effected, as well as a destruction of the enzyme residues which eventually have a noxious influence on the intraocular tissues. Irrigation has to be done very slowly, in order to avoid liberation of the iridic pigment, which otherwise will be deposited on the anterior hyaloid membrane, and also to avoid rupturing the membrane and the loss of vitreous.

The sclerocorneal sutures are tied after careful replacement of the conjunctival flap. This precaution helps to prevent epithelization. Air is introduced into the anterior chamber. The conjunctiva is irrigated with penicillin solution in order to remove all traces of the enzyme persisting at the level of the conjunctival section. Myotics are used. The first dressing is done after 48 hours.

The technique is identical for the extraction of a pathologic cataract. One must not omit making a small section of the iris sphincter at the 6-o'clock position in order to prevent eventual pupil ascension.

With traumatic cataracts, care should be taken to search, before proceeding with the

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injection of the enzyme into the anterior chamber, for posterior adhesions of the iris and to break them with the help of an iris spatula, because the enzyme has no effect on them. It is understood that total extraction is attempted only if the lens is absolutely intact or presents only a very small rupture. In this case the lens is taken at the level of the rupture and is easily extracted. We have noticed, however, that, in cases in which the lens is broken, use of the enzyme after irrigation of the lens remnants, facilitates extraction of the whole crystalloid.

Intracapsular extraction of congenital cataract would be an ideal technique but it is not always possible because of frequent adhesions between the posterior crystalloid and the vitreous. These cataracts are sometimes, mainly in very young children, so solid that the vitreous is pulled with the lens as if the two structures were one. In the presence of this type of adhesions and after injection of the enzyme, an experienced assistant must undertake to separate the lens from the vitreous to which it adheres, with the help of a blunt spatula, while the surgeon raises and progressively pulls the lens. If, in spite of all precautions, the hyaloid is broken, the loss of the vitreous is of relatively little importance because the wound can be rapidly closed with the help of the six sclerocorneal sutures which were placed in position immediately after the corneal section.

Excessive mydriasis is to be avoided. If it does occur, a few drops of acetylcholine are instilled immediately after the opening of the anterior chamber. Also the iris diaphragm does not permit loss of a large quantity of vitreous in case the hyaloid ruptures. If we notice, on the day before the operation, that the pupil reacts poorly to the mydriatic, we prefer to do an extracapsular extraction because poor mydriasis is often due to posterior iris adhesions.

Numerous reports have already been published on the use of alpha chymotrypsin. The most frequent complications mentioned by others are the pupillary ascension, delay in reformation of the anterior chamber and rupture of the hyaloid. We noticed, however, that these complications were also observed before the use of the alpha chymotrypsin. It would seem necessary to ascertain whether these complications are more frequent after the use of the enzyme and whether really they can be attributed to the enzyme acting in noxious manner on the intraocular tissues. One also should consider the operating technique of each surgeon. It is up to histologists and biologists to study the influence of the enzyme on the intraocular tissues. We will limit ourselves to the study of the complications which we have observed most frequently.

We are of the opinion that pupillary ascension can be provoked when injection of the enzyme is not made along the full length of the equator of the lens. One tends to inject toward the bottom and laterally but not toward the 12-o'clock position, or at least not sufficiently. An imperfect dissolution of the zonule toward the top results, because the enzyme acts only by direct contact. The lens may evidently be well extracted but, after a few days, the remnants of the zonular fibers pull the iris toward the top, provoking its ascension. We have come to this conclusion after a systematic postoperative gonioscopic examination of the eyes showing such a complication. We have revealed the presence of very fine zonular fibers radiating from the posterior face of the iris, which are directed toward the operated wound, raising the iris like a band.

Another factor which can provoke ascension of the iris is the too-deep placement of the sclerocorneal sutures. This results in the formation of an exudate which is slowly organized and closes, at this level, the angle of the anterior chamber, thus provoking the ascension.

The delayed rupture of the hyaloid can also provoke an ascension. But can this delayed rupture be attributed to the enzyme? Experiments carried out in our laboratory on enuclated eyes, consequently pathologic, have

not disclosed any noxious influence on the hyaloid. The eyes remained in contact with the enzyme for three days. The histologic sections of these eyes have not revealed any damage to the tissues. The frequency of delay in reformation of the anterior chamber, or its obliteration, has noticeably diminished since the use of six to eight sclerocorneal sutures placed in position immediately after the opening of the anterior chamber. Thus one avoids, after the injection of the enzyme, any action which could provoke rupture of the hyaloid.

Among the 812 different cataracts operated in our clinic, the incidence of pre- or postoperative complications which we observed was: ruptures of the crystalloid, 6.3 percent; prolapse of the iris, 2.8 percent; obliteration of the anterior chamber, 1.8 percent; ascension of the pupil, 2.8 percent; and vitreous prolapse, 5.2 percent.

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## ACCOMMODATION IN THE AMBLYOPIC EYE*

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Accommodation is usually considered a bilateral affair. According to Lyle and Bridgeman[1] unequal accommodation is possible in normal persons under demanding conditions, as in fixing an object situated laterally. The variation between the two eyes may be as much as two diopters or even more. Grimm[2] suggested that a difference in accommodation of 1.5 diopters may be present in cases of unequal errors of refraction even with fixation in the sagittal plane.

In a study conducted years ago on amblyopia, I suggested[3] that (1) a difference in refraction between the two eyes of two diopters or more in the spherical correction, (2) a difference in the astigmatic correction between the two eyes of 1.50 diopters or more and (3) a difference in any meridian of one eye from its counterpart (corresponding meridian) in the other eye by 2.00 diopters or more would usually be reflected in the visual acuity obtained by the first correction. I also showed that a limited amblyopia of the more ametropic eye was present even without a demonstrable strabismus by the cover test.

In such cases of anisometropia the difference in visual acuity is usually considered due to a "passive" amblyopia that has developed because a poorer image has been formed by the more ametropic eye. This belief is in keeping with the thought that accommodation usually cannot be expected to compensate for the unequal error of refraction by unequal activity to the extent needed.

If this is so, and it seems reasonable on a clinical basis to think it is, then are we assuming that accommodation, in such cases, is unequally active to the extent of its ability even though such activity does not give a sufficiently clear image to prevent amblyopia? Are we correct in assuming accommodation to be active to a normal or even greater than normal extent in such ametropic-amblyopic eyes?

An old physiologic principle states that a function which cannot accomplish its intended purpose usually tends to surrender the effort. Can we believe that here we have a function which is active in defiance of this old principle? Isn't it more logical to assume the amblyopia found in such cases, in part at least, to be a result of less than normal activity of accommodation?

If this principle is true, then our ideas of bilateral activity of accommodation may need modification. If this principle is true, then such cases, as well as cases of unilateral

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strabismus, should show less accommodation ability than normal—less than the more normally functioning eye.

Urist[4] and Costenbader,[5] referring primarily to some cases of convergent strabismus in which the deviation is increased at near, presume a bilateral weakness in accommodation with resulting overaction (or overstimulation) of accommodation to compensate for this weakness. Urist[6] seems also to have this thought in mind in explaining secondary deviations. However, he does point out, in at least two of his cases, that accommodation is weaker in the more ametropic eye in anisometropia. His actual measurements of accommodation are made (in these two cases) with ambloypia still present, and, therefore, with the inaccuracies inherent in such measurements. He does, however, deserve credit for his observations.

That accommodation can be a unilateral affair is not generally conceded. According to the old principle of use and disuse, it should be expected that an organ relatively unused, as in amblyopia, should show a weak accommodation. Such a finding should not be too surprising. This fundamental rule of nature is demonstrated by the lack of response of an amblyopic eye or a relatively blind eye to anterior chamber punctures (Abraham,[7] Kronfeld.[8])

It is not surprising that the literature is relatively barren on this subject of accommodation in the amblyopic eye. Weakness of accommodation is not easily proven. Eyes with subnormal vision cannot be accurately tested subjectively for their accommodative power; and the period of use of an amblyopic eye during which the vision improves to normal is also the period in which accommodation is increasingly used. Usually the youthfulness of the patient precludes accurate testing.

In this presentation evidence is presented which suggests that accommodation may be functioning subnormally, if at all, in cases of anisometropia and in cases of unilateral strabismus with amblyopia.

The evidence herewith presented consists of those cases of amblyopia in which the corrected vision of the amblyopic eye has improved to equal that of the normal eye. Here, in the isometropic strabismus cases, the refraction is so nearly equal that the visual disparity cannot be explained by the ametropia. The one explanation that fits is that improvement in accommodative ability has not kept pace with improvement in the amblyopia.

In two previous publications (Abraham[9,10]), reference to this weakness of accommodation in the amblyopic eye was made (Case 14 in the first article,[9] and Cases 1 and 2 in the second article[10]). Additional cases illustrating this phenomenon are herewith presented.

## Case reports

### Case 1

A boy, aged 12 years. Eyes straight with glasses following amblyopic and surgical treatment and the use of miotics. There was minimal, less than five degrees of left convergence without glasses. Right vision with +4.00D. sph. = 1.2, left vision with +4.25D. sph. = 1.2 — 1. Right vision, 1.2 — 3 without glasses, left vision, 1.0 without glasses. Punctum proximum of accommodation without glasses, right, 5.5 to 6.0 inches; left, 7.0 to 7.5 inches.

### Case 2

A girl, aged 10 years. Eyes straight with glasses following surgery, left amblyopic treatment, miotic therapy. Right and left vision = 1.0 with glasses. Atropine refraction, right and left, +6.0D. sph. ⊃ +2.0D. cyl. ax. 90°. Unaided vision right = 0.8 — 2, left = 0.4 — 2. Left periodic convergence (0-25 degrees) without glasses.

### Case 3

A boy, aged 14 years. Eyes straight with glasses. Original right amblyopia and right convergence treated. Has had surgery and has also used miotics. Find minimal right convergence without glasses. Right vision with +2.0D. sph. ⊃ +0.75D. cyl. ax. 90° = 1.0, left vision with +2.75D. sph. ⊃ +0.25D. cyl. ax. 90° = 1.0. Right vision without glasses =0.3, left vision without glasses =0.6.

### Case 4

A boy, aged 10 years. Eyes straight with glasses. Surgical and amblyopic treatment given plus use of miotics. Right, +3.50 = 1.0°, left, +3.00 = 1.0. Without glasses left convergence 10 degrees. Right vision =1.0, left vision =0.8 without glasses. Additional amblyopic treatment (atropine right eye) improved left vision to 1.0 and no further convergence without glasses.

CASE 5

A girl, aged six years. Left more than right convergence since the age of three years. Glasses, amblyopic treatment and surgery. Eyes straight with glasses after surgery and at times without glasses. Minimal left convergence without glasses. Atropine findings: Right, +5.5D. sph. ⌒ +0.75D. cyl. ax. 85°; left, +5.5D. sph. ⌒ +1.25D. cyl. ax. 90°. With +1.5D. sph. less each eye, right vision =0.6, left vision =0.6. Without glasses, right vision =0.6, left vision =0.2.

CASE 6

In a previous report[8] Case 5 was used as an example in describing miotic therapy. This patient was followed for several years more because of recurrence of the strabismus and the amblyopia. When the patient was eight years of age the corrected vision was equal in the two eyes (1.0). The error of refraction was also equal (Right and left +1.25D. sph. ⌒ +0.75D. cyl. ax. 90°). With the correction, the right eye required, a +2.0D. add to equalize near vision. Unaided vision was R = 1.0. A right convergence of 10 degrees was noted without glasses, while the convergence was minimal and periodic with glasses or miotics. Six years later uncorrected vision was equal at distance and near, no squint was demonstrable and stereopsis was normal.

CASE 7

This patient was 10 years of age. No strabismus noted. History of poor right vision for several years. Has had amblyopic treatment. Uncorrected vision R = 0.1, L = 1.0. With glasses R = 0.8+2, L = 1.0. Cycloplegic findings R = +3.50, L = +1.75. Near-point of accommodation without glasses R = 5.5 inches, L = 2.5 inches. Fly test negative for stereopsis.

CASE 8

This patient was 18 years of age. Left vision was never as good as right vision. Has worn glasses since two years of age. First seen in 1950. Atropine refraction in 1950 was, R = +4.25D. sph. ⌒ +0.5D. cyl. ax. 90°, L = +3.75D. sph. ⌒ +0.5D. cyl. ax. 90°. Left convergence of 20△. Has had amblyopic treatment and surgery. Best left corrected vision at any time in past 10 years was 0.8+. Right vision was always 1.0 with correction. In 1960 (patient aged 18 years) refraction under cyclopegia was R = +0.5D. sph., L = +2.25D. sph. ⌒ +0.25D. cyl. ax. 60°. Accommodation tests with correction (without add) showed P-P. R = 7.5 inches (on 0.37 type), L = 9.5 inches (on 0.75 type). This patient has type II fusion only.

## COMMENTS

These cases may serve as proof of the accommodative weakness in unilateral strabismus of the isometropic type and in cases of anisometropia. It is suggested in some cases that this weakness is a factor in the status of the strabismus at a late stage in the treatment. The findings suggest that further treatment may be indicated for the accommodation. These findings may justify the use of bifocals in those cases showing accommodative weakness. However, I have found bifocals in children very unreliable as a method for helping a weakened accommodation or for indirectly decreasing the overconvergence action on near fixation.

The possibility that a weakened accommodation may have been present at the onset of a strabismus, and may even have been a factor in the production of the strabismus, should not be entirely overlooked.

## SUMMARY

Eight cases are presented which suggest that amblyopia in cases of strabismus and anisometropia may be accompanied by unilateral subnormal accommodation. This may be an obstacle to a cure in some cases of strabismus and may persist even when the distance vision has been markedly improved.

The cases presented suggest that accommodation may be a unilateral affair more often and to a greater degree than is usually suspected.

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# COMBINED INTERNAL AND EXTERNAL APPROACH IN LEVATOR RESECTION*

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Levator resection may be performed either through a skin incision or through the conjunctiva. After surveying 147 cases, Berke[1] concluded that the external method for resection of the levator was better than the internal operation on congenital blepharoptosis because (a) it produced a greater amount of correction and (b) the operation was easier for the average surgeon.

For a few years I had been using Berke's older method[2] of levator resection (conjunctival approach) and had found it effective in most of my patients. However, in a few of them the shape of the lid curvature was not as attractive as I wished to see and there was often no distinct lid fold line. Moreover, there were two patients in whom it was needful, in addition to levator resection, to excise an elliptical piece of skin which was markedly redundant. For this reason, I started doing a few cases through the external approach so that a good-looking lid fold could be created, using a method similar to that of Sayoc.[3] Figure 1 shows the first patient in this series to undergo the operation herein described.

The technique I employ for the resection of the levator is essentially the same as that described by Johnson,[4] Leahey,[5] and Berke[1] except for the following points: (a) a conjunctival incision is made as in the internal approach; (b) the ptosis clamp grasps only levator tissue—no conjunctiva; (c) the levator muscle is reattached approximately over the edge of the tarsus, and is not advanced close to the lashes; (d) the second anchorage of the levator muscle is omitted; (e) five interrupted mattress sutures are used to anchor the levator; (f) a lid fold is formed after Sayoc's method.

## PRINCIPLES OF PTOSIS SURGERY

An ideal ptosis operation is one that restores both the appearance and the function of a congenitally defective and malfunctioning upper lid, with the minimum of surgical trauma and the least alteration of normal anatomy and physiology. The new insertion of the levator muscle is as close as possible to what nature has originally intended, and a good-looking lid fold (superior palpebral fissure) is created or restored. There is no ugly scar or keloid formation and the lid curvature is graceful or at least preserved.

With these principles in mind, I have combined the good features of both the internal (conjunctival) and the external (skin)

Fig. 1 (Carbajal). A 12-year old Caucasian boy with marked ptosis and blepharophimosis in both eyes, undergoing levator resection through the external and internal routes and canthoplasty in one operation. Pictures taken about a year after surgery. (a) Patient looking straight ahead, (b) down, (c) up and left, and (d) up and right.

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routes. The results thus far have been satisfactory.

### Ptosis workup

All patients were examined personally by me before operation. The workup for ptosis included the various steps enumerated in a previous article.[6] The levator function is calculated after Berke's method. The superior rectus function and muscle balance as a whole are evaluated as accurately as possible. Marcus-Gunn phenomenon is always watched for. The lid folds in both eyes are measured and compared. The lids are everted in order to detect the presence of palpebral conjunctival disease (spring catarrh, trachoma, and so forth). Also, the size of the tarsal plates can be calculated roughly.

### Operation

The operation is performed under general anesthesia in order to prevent distortion of the lid tissues from local infiltration with an anesthetic.

### Steps of operation

1. A horn spatula is inserted in the upper fornix under the upper lid and a superficial skin incision (fig. 2) is made following the normal position of the lid fold, which is usually three to five mm. from the lashes. This incision is to be deepened later.

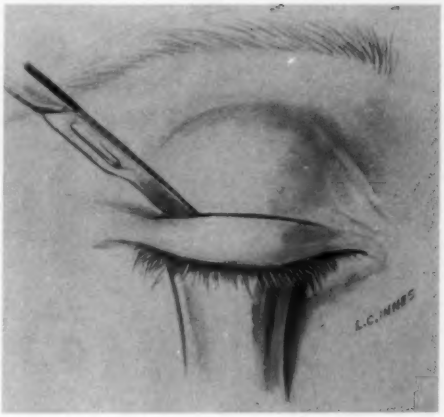


Fig. 2 (Carbajal). Incising the skin, which is supported by a horn spatula.

2. The upper lid is double everted on a Desmarres lid retractor, and with a Bard-Parker No. 15 blade the conjunctiva is cut free from its attachment to the upper edge of the tarsus. The conjunctiva is then carefully undermined (fig. 3) and freed from Mueller's muscle for a distance of five mm. to allow positioning of a ptosis clamp on the levator insertion.

3. A horn spatula is reinserted in the upper fornix under the upper lid, and the original incision is now deepened, cutting through the skin and orbicularis the full length of the lid. After careful dissection,

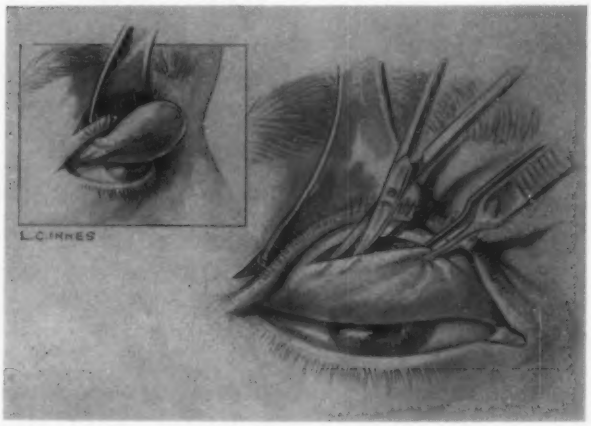


Fig. 3 (Carbajal). Double everting the upper lid on a Desmarres speculum and incising the conjunctiva and freeing it from Mueller's fibers.

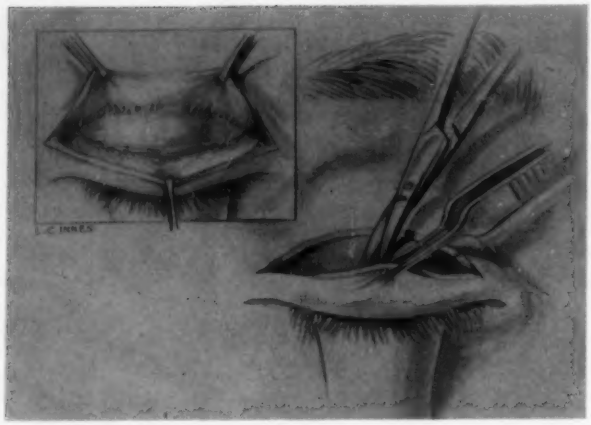

Fig. 4 (Carbajal). Reflecting the skin and orbicularis from underlying structures.

the skin and orbicularis are then reflected from the septum orbitale above and from the tarsus halfway to the lashes in order to facilitate suturing for the lid fold later (fig. 4).

4. An Erhardt clamp is applied to the tarsus and the lid pulled down. Then the septum orbitale is opened (fig. 5) by blunt scissors dissection and cut free from the upper edge of the tarsus.

5. Two stab incisions are made through the levator aponeurosis (but not through the conjunctiva) close to the tarsus about 20 to 25 mm. apart. A Berke ptosis clamp is applied, and the levator is cut free from the tarsus (fig. 6).

6. The ptosis clamp is pulled upward and the conjunctival dissection which had been previously started is now continued for a distance of another five mm. The levator is freed by blunt scissors dissection from

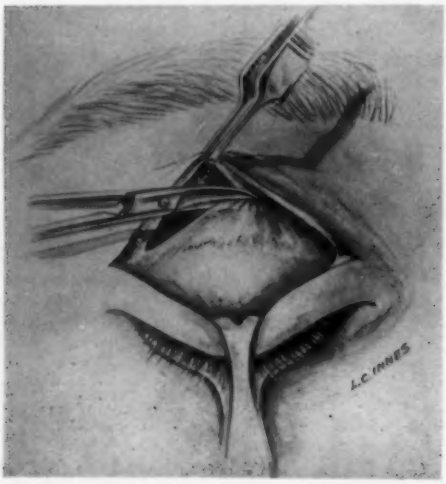

Fig. 5 (Carbajal). Cutting the septum orbitale from the upper edge of the tarsus.

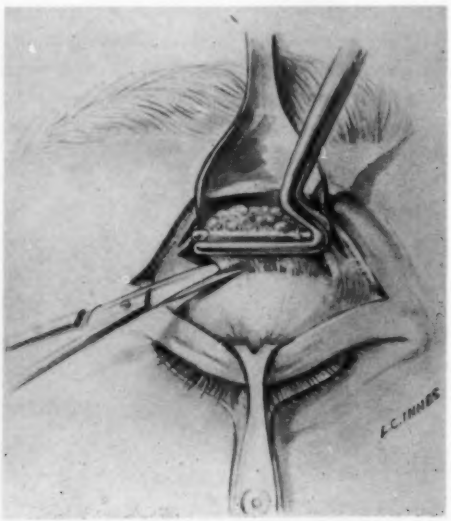

Fig. 6 (Carbajal). Severing the levator from the tarsus. Take note of the manner of using the clamp to facilitate cutting the levator insertion on the tarsal edge. Later, after further conjunctival dissection, the clamp is reapplied in the opposite direction (see fig. 7).

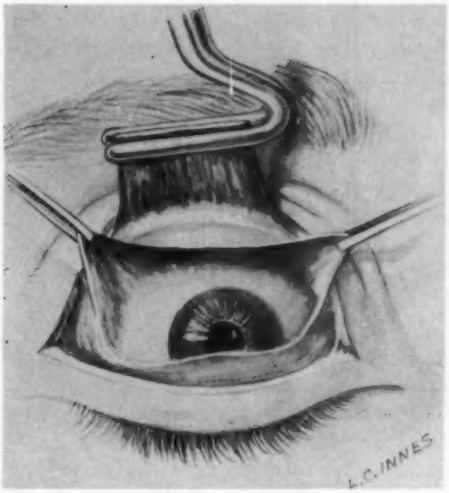


Fig. 7 (Carbajal). Illustration showing the levator freed from Tenon's capsule above the upper fornix.

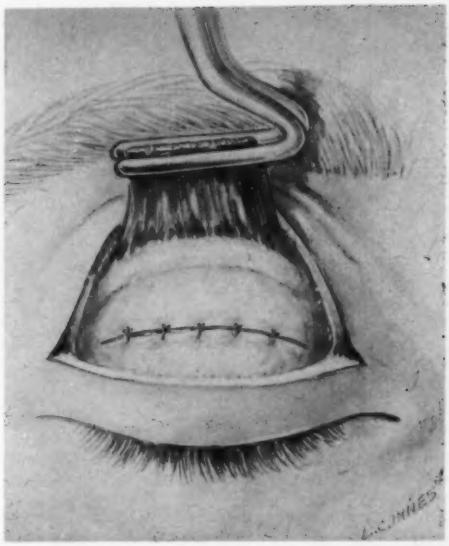


Fig. 8 (Carbajal). Suturing the conjunctiva to the upper edge of the tarsus.

Tenon's capsule for a short distance above the upper fornix. Care should be exercised to avoid freeing the conjunctiva from the sclera down to the limbus, causing the upper fornix to prolapse over the upper cornea postoperatively. To facilitate further exposure of the levator muscle, the ptosis clamp is reapplied in the reverse direction (fig. 7). Then the conjunctiva is sutured to the upper edge of the tarsus (fig. 8).

7. The lateral horn and the check ligaments are severed (fig. 9) while a horn spatula is placed under the levator. The spatula prevents injuring the main portion of the lacrimal gland* and the superior oblique reflected tendon. The mobility of the freed levator is now checked, making sure that there are no residual attachments to the septum orbitale, to the superior rectus, and to the lateral and medial walls. The tendency of orbital fat to prolapse is often encountered, but is seldom severe enough to warrant excision.

8. While the upper lid is supported at the

Fig. 9 (Carbajal). Illustration showing approximate areas where the horns and check ligaments are cut to free the levator, allowing greater flexibility and mobility of the levator muscle.

* The small lobules of accessory lacrimal gland often encountered while incising the lateral horn may be excised with impunity.

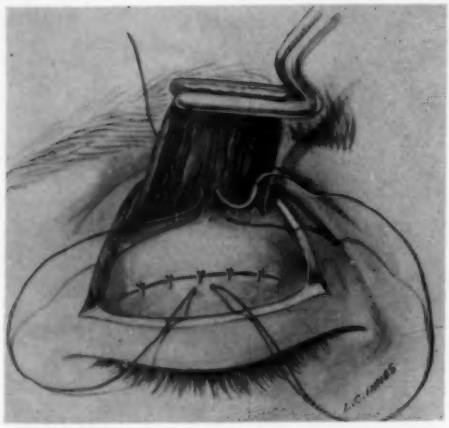

Fig. 10 (Carbajal). Inserting the central mattress suture through the levator, through the tarsus, and through the levator again.

proper height of the cornea, the levator is pulled downward over the lid, and the point where the levator crosses the upper edge of the tarsus is marked or at least mentally noted. Then comparison is made between the amount of levator to be resected and the amount of levator exposed above the area of resection. The former should never be more than twice the latter; otherwise, lagophthalmos will result.

9. Three double-armed 4-0 chromic sutures are inserted through the tarsus (half thickness) about one mm. from the freed tarsal edge (fig. 10), the middle suture corresponding with the center of the freed tarsal edge. The side sutures are five to six mm. on each side of the central suture. These double armed sutures are then passed through each third of the muscle at the point previously marked or noted.* The anchorage of the levator to its new position is further strengthened by using double-armed 5-0 plain absorbable gut sutures between the aforementioned sutures. This not only makes the line of insertion smooth but also prevents the tendency to tenting of the lid margin.

10. The excess levator muscle is resected off (fig. 11), leaving one mm. to prevent slippage of the sutures now attaching the levator to the tarsal edge.

11. The skin incision is closed with plain absorbable gut sutures (5-0) in children who cannot co-operate during suture removal (less than four years of age); otherwise, 6-0 black silk is used as this is less prone to produce skin reaction and/or granuloma. In the closure of the skin-orbicularis incision, the needle is passed through the lower lip of the incision, then through the superficial layers of the tarsal plate, and finally through the upper lip of the incision (fig. 12).

12. The upper fornix (cul-de-sac) is inspected and, if necessary, a muscle hook is gently used to replace the fornix in position.

13. Two modified Frost[7] sutures, tied over rubber pegs (fig. 13), are passed through the gray line of the lower lid and anchored over the brow to pull the lower lid up, thus protecting the cornea.

14. After an antibiotic ointment has been smeared over the lids, as well as into the interpalpebral fissure, the lashes are straightened out, and a firm roller gauze pressure dressing is applied for three days.

### Comment on technique

Surgery using this technique has been performed on 20 eyes, with satisfactory results in all patients. The lid folds have remained symmetrical in all patients with unilateral ptosis as well as in the five undergoing ptosis surgery on both eyes. This includes four patients who obtained no benefit from Blaskovics'[8,9] procedure. Marked edema of the lid occurred in two patients (fig. 14) in whom the ptosis for a time was thought to have been undercorrected but, after the edema disappeared, a satisfactory result was obtained. The edema resulted from hypersensitivity to gut sutures. There was no sig-

* At this stage of the operation, the sutures are tied temporarily and the location of the upper lid in relation to the pupil is evaluated. If the desired height of the lid has not yet been reached, the sutures would be better reinserted farther back by two to five mm., as necessary. On the other hand, if the lid appears hung-up, the sutures should be reinserted more anteriorly.

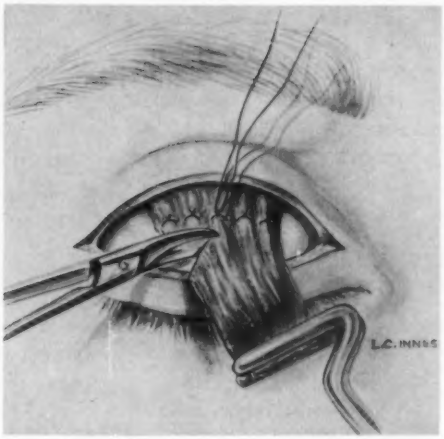


Fig. 11 (Carbajal). Resecting off the excess levator muscle.

nificant scar formation following surgery. There was no keloid formation!*

In a three-year-old girl (case of Bourneville-Ulrich syndrome) with marked ptosis (fig. 15) associated with marked frontalis

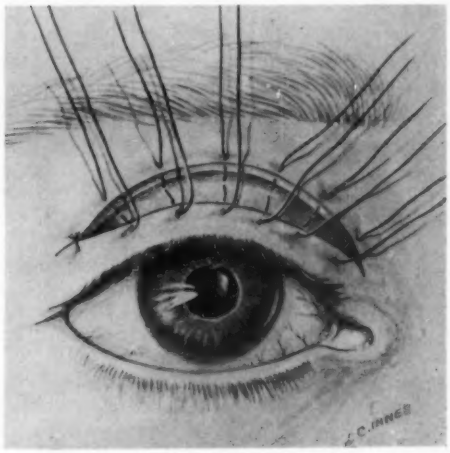


Fig. 12 (Carbajal). Closing the skin incision.

* Preoperatively, patients should be examined as to presence of prominent scars or keloid growth anywhere in the body. The parents should be questioned as to tendency to keloid formation in the family. If present, steroid therapy should be instituted during the first week after surgery.

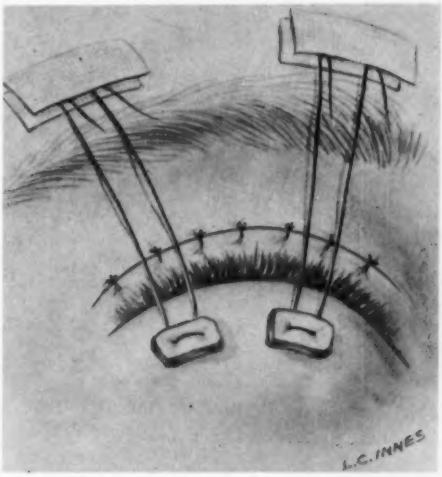


Fig. 13 (Carbajal). Frost sutures in place.

Fig. 14 (Carbajal). Moderate edema of the left upper lid three weeks following levator resection through the combined route. This six-year-old Negro had marked ptosis of the left upper lid since birth. (a) Full-face picture, showing muscle imbalance and marked frontalis action. (b) Close up picture of eye, showing the undisturbed condition of the eyelashes.

Fig. 15 (Carbajal). Case of Bourneville-Ulrich syndrome. (a) Preoperative picture. Note the slit-like palpebral fissures despite the face-distorting frontalis action. Note also the neck web. This patient had mild coarctation of the aorta. (b) Six weeks after levator resection (combined route). (c) Eight weeks after surgery. Note the good-looking lid folds. Two months after the ptosis operation, bimedial recession and resection of the right lateral rectus were done with good result. Lagophthalmos is surprisingly minimal and there is no exposure keratitis.

overaction, this ptosis procedure resulted in considerable improvement of the patient's appearance. Ordinarily, an ophthalmic surgeon would utilize a sling procedure in such a case.

This procedure is no more difficult than other ptosis techniques, and may be completed in approximately one hour. In one bilateral case, the procedure lasted an hour and a half. Because of the direct apposition of the levator to the tarsal plate and the secure suturing, the eye may be uncovered on the third day without fear of suture slippage. Since there is no excision of tarsal plate or conjunctiva, the dimensions of the lid and cul-de-sac are not altered. There is less postoperative edema because of less dissection toward the lashes and because no rubber pegs are used near them.

When the levator is advanced close to the lashes, their alignment is often disturbed; and a few lash roots may become permanently injured. There is also conspicuous thickening of the lid due to the bulk of the advanced levator, giving the appearance of bogginess of the skin of the lid, which normally is thin and delicate. These two disadvantages have not been and should not be encountered in the procedure herein described.

One great advantage of this procedure over that of Blaskovics' as modified by Berke (conjunctival route) is that even a very thin, poorly developed levator can be isolated satisfactorily. At this point I wish to emphasize that the ptosis clamp should never be overly pulled because the levator muscle is fragile in children less than three years of age. Great care should be exercised to separate Mueller's muscle from the conjunctiva and to incorporate the former with the reattached levator.

## Summary

A modified ptosis procedure combining the merits of both the internal and external routes is presented. The technique is discussed, with emphasis on the prevention of complications. The chief advantages of the procedure over other techniques are: (1) a normal looking lid fold is created; (2) a lid curvature which is unmarred by tenting results from the use of five mattress sutures in reattaching the levator to the edge of the tarsus; (3) overcorrection is prevented by avoiding advancement of the levator muscle, which often is already resected too much; (4) since the tarsal plate and conjunctiva are not resected, the superior cul-de-sac is not altered; (5) the levator muscle is clearly exposed and freed of check ligaments (horns) and is separated completely from the septum orbitale. This, together with the care exercised in not resecting the tarsus and conjunctiva, prevents permanent postoperative lagophthalmos. Although this report is based on a small series, the results have been gratifying.

*789 Vito Cruz.*

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# SYNDROMES WITH CONGENITAL CATARACT*

## XVI Jackson Memorial Lecture

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It is indeed an unusual honor to have been invited to give the Edward Jackson Memorial Lecture. Dr. Jackson, who was born in 1856 and died in 1942, was one of the greatest American ophthalmologists. His name was, and is still, held in high esteem, not only in the United States but also across the ocean and all the world over. His book on skiascopy and on refraction, written in 1895, is still a classic and Jackson's cross cylinders are well known everywhere. Since I have read the homage paid to Edward Jackson by those who knew him and his work, and since I have read his papers, which contain so many original ideas, I am filled with as much admiration as veneration for the physician and the ophthalmologist with his deep wisdom and brilliant erudition; for the investigator and the scientist with his penetrating knowledge and vigorous spirit; for the master and the teacher with his clearness of thought and his analytic mind; for the writer with his great facility of expression, and, above all, for the man with his charming kindness, his attractive modesty, his winning simplicity, his appeasing gentleness and his fundamental goodness.

In many cases the etiology of congenital cataract is obscure. Out of 217 cases of large lens opacities, we have been able to establish the cause in only 70. In 45 cases, there was a hereditary factor; in 12, rubella of the mother; in six toxoplasmosis; in two galactosemia; in one, syphilis; in one influenza of the mother; and in one, perhaps sulfonamide poisoning.

To increase the chance of finding a cause, it is therefore indispensable not only to consider the maternal and familial antecedents, but also to examine systematically the child affected with cataract. All concomitant anomalies must be revealed if one is to be able to connect them, if possible, with a syndrome to permit the establishment of the genetic nature of the disease. One must bear in mind that a pathologic gene may have a variable expressivity and may also give rise to a pleiotropic, polyphenic or even heterophenic manifestation.

We understand a syndrome as a clinical entity not presenting a series of symptoms involving one single organ or one single system, but characterized by an association of dissimilar anomalies without any apparent interrelationship, since they may involve various organs, various systems and various tissues at one time.

We shall discuss successively Lowe's syndrome, the association of congenital cataract and oxycephaly, that of congenital cataract and apical malformations, stippled epiphyses, Bonnevie-Ullrich's disease, François' syndrome, congenital hemolytic icterus, Sjøgren's syndrome, Marinesco-Sjøgren's syndrome, mongolism, and syndermatotic congenital cataracts.

### 1. Lowe's syndrome

In 1952, Lowe and his co-workers described a syndrome manifesting itself in infants. It was characterized by the following signs and symptoms:

1. *Renal symptoms.* Tubular and sometimes glomerular lesions; amino-aciduria; disturbance of ammoniogenesis (very scanty spontaneous ammoniuria and insufficient response to the ammonium salt stress test); albuminuria and intermittent glycosuria

2. *Vitamin-resistant renal rickets,* with pigeon breast, craniotabes, irregular ribs, en-

* From the Ophthalmological Clinic of the University of Ghent, Director: Prof. Jules François. Presented at the 64th annual session of the American Academy of Ophthalmology and Otolaryngology, October 11-16, 1959, Chicago.

larged epiphyseal extremities, spontaneous fractures, retarded ossification

3. *Retardation in stature and weight* (a certain degree of nanism) and *retarded psychomotor development*

4. *Muscular hypotrophy* with generalized hypotonia and hyporeflexia

5. *Mental deficiency*

6. *Ocular symptoms,* either congenital cataract or glaucoma.

Congenital cataract, which was observed in 14 out of 16 cases, may be either total (Appelmans and co-workers, 1957) or nuclear (personal observation); it may be combined with cataract of the posterior pole (two cases of Gerard-Lefebvre and co-workers, 1957). When it is total, it is either soft or chalky.

Glaucoma, as observed in eight out of 16 cases, is either of the congenital type, with buphthalmia (Lowe and co-workers, 1952; Falls, 1959), or of the simple type (Streiff and co-workers, 1958).

In seven cases the cataract was associated with glaucoma (three cases of Lowe and co-workers, 1952; one unilateral case of Appelmans and co-workers, 1957; one case of Falls, 1959; two unilateral cases of Schoen and Young, 1959).

Other ocular symptoms to be noted are searching nystagmus (in 10 out of 12 cases), enophthalmia, divergent strabismus (Streiff and co-workers, 1958), Franceschetti's digital-ocular sign, and atrophy of the iris with photomotor areflexia (Appelmans and co-workers, 1957).

From a chemical point of view, findings were hyperchloremic acidosis, hypophosphatemia with diminution of the alkali reserve; lowering of the phosphorus content and increase of the alkaline phosphatase content.

Other manifestations, observed were intermittent fever, trembling crises, stridor, digestive disorders with vomiting, electroencephalographic changes, skin anomalies (eczema, dry and rough skin), general malformations (camptodactylia, pes cavus, cryptorchism, sunken or flat chest, hernias, cox plana, macrognathia, anomalies of the external ear, arched palate, microdontia, retrognathia, saddle nose, hypertelorism, brachycephaly with precocious closure of the sutures, parietal, occipital and frontal bulgings, internal hydrocephaly).

Lowe's disease, of which 20 cases are now known, seems to be due to a hereditary factor. Gerard-Lefebvre and his co-workers (1957), as a matter of fact, observed the familial occurrence of the syndrome. Two brothers were affected, and also a cousin; the mothers were sisters. The brother of Schlesinger's patient (1956) probably showed the same affection and also the brother of Breton's patient (1959). We saw the disease in two brothers. Schoen and Young (1959) observed a concordant manifestation in the two partners of a pair of identical twins. The parents of the patient of Debre and his co-workers (1955) both had marked amino-aciduria: 13 amino-acids for the father, 12 for the mother. The father of the patient of Streiff and his colleagues also had amino-aciduria (nine amino-acids).

Considering that all the patients known up to now (12) are males, Streiff (1958) reached the conclusion that there was sex-linked recessive heredity. Franceschetti (1958), however, believes that in view of the small number of cases, autosomal heredity limited by sex cannot be excluded.

## II. Congenital cataract and oxycephaly

The association of congenital cataract with oxycephaly (fig. 1), less frequently with plagiocephaly, constitutes a real syndrome, which has repeatedly been mentioned: Groenouw (1901), Kraus (1902), Alexander (1903), Patry (1905, three cases), Aubaret and Guillot (1934), Lartigue (1939, two cases), Sourdille and co-workers (1939, 1946, 2 cases), Gänsslen (1940), Falls (1943, two cases), Walsh (1947), Renard and Laporte (1951), Vest (1955). There is usually a zonular cataract, which may be accompanied by other ocular manifestations,

due to oxycephaly (optic atrophy, exophthalmia, and so forth).

### III. Congenital cataract and apical malformations

The combination of congenital cataract and apical anomalies, which is often familial, has been described by numerous authors: Appenzeller (1884, polydactyly), Ginestous and Lavie (1903, syndactyly), Manson and Nettleship (1912, polydactyly), Koby (1923, camptodactyly), Rieger (1941, polydactyly). In a case described by Karsch (1937), the congenital cataract was associated with tapetoretinal degeneration and apical dystrophy of the "lobster-claw" type. The tapetoretinal degenerations may be accompanied by congenital cataract, especially in Bardet-Biedl's syndrome, of which polydactyly is the classical symptom.

### IV. Congenital stippled epiphyses

Stippled epiphyses, also called Contradi's syndrome (1914), congenital calcareous or calcifying chondrodystrophy (Hünermann, 1931), dysplasia epiphysialis punctata or chondrodystrophic epiphyseal fetal calcinosis, is a congenital affection which manifests itself from early infancy, in the first few days or months after birth.

The very high mortality in the first two years of life and the regressive development of the disease if the patient survives, explain why the diagnosis is rarely made after the age of two years. The affection is rare; only about 50 cases of it are known.

Fig. 1 (François). Congenital cataract and oxycephaly.

#### Symptomatology

The clinical and radiologic signs, which are of primary importance, are accompanied by various dystrophies, and also by a bilateral total congenital cataract.

#### Clinical signs

1. The *shortening of the long bones* is characteristic. Whereas the length of the trunk is normal, there is a more or less marked micromelia, which reduces the height considerably (figs. 2 and 3). This micromelia is not harmonious; it shows definite rhizomelic predominance and gives the new-

Fig. 2 (François). Stippled epiphyses with congenital cataract.

Fig. 3 (François). Stippled epiphyses with congenital cataract.

born the appearance of achondroplasia (disproportionate nanism). It involves the legs more than the arms, and the proximal parts more than the distal. Moreover, it is often asymmetrical, that is, the reduction in length of the limbs on one side is more pronounced than on the other (Jeune et al., 1953).

2. *Morphologic anomalies* of the bones are often observed: enlargement of the metaphyseal extremities; incurvation of some diaphyses, especially of the femur; kyphoscoliosis; digital anomalies; malformations of the feet, and so forth (Resnick, 1943; Duffy and Vinke, 1947; Ford, Schneider and Brandon, 1951; Schönenberg and Shallock, 1953).

3. In half of the cases there is *articular dysfunction* (fig. 4), with abnormal posture in flexion, limitation or abolition of movements, and pain on passive movement, involving one or several large joints of the limbs (knee, hip, elbow), sometimes the joints of the hands and fingers, rarely those of the neck. These articular anomalies are not always due to bone malformations, but are sometimes caused by a fibrous change in the muscles (Lund, 1943).

### Radiologic signs

1. The roentgenograms of the skeleton show *epiphyseal calcifications*, which constitute the main sign of the affection. These calcifications are more or less regularly dis-

Fig. 4 (François). Stippled epiphyses with congenital cataract.

tributed between the metaphyses and the articular surfaces. They are often very numerous and fairly dense, either round or angular in shape, and their size ranges from that of a pin's head to bird shot, rarely reaching the size of a cherry stone. They may remain localized in a portion of a limb or in some joints (Swoboda, 1950), but generally, and even in the absence of clinical signs, they are dispersed throughout the skeleton, especially in the epiphyses of the long bones, with a marked predilection for the extremities of the humerus and femur (figs. 5, 6, 7, 8, and 9). Apart from these calcified spots, the epiphyses are absent or enlarged and deformed.

2. Another frequent roentgenographic finding is that of *metaphyseal deformities*, in the shape of a trumpet, a spur or a mushroom (Bateman, 1936), combined with anomalies of the ossification line, which is irregular, convex, concave or markedly oblique.

These cardinal signs are often accompanied by other dystrophic manifestations:

1. *Cutaneous manifestations.* Thickening of the skin with hypertrophy of the panniculus adiposus, rough and scaly skin (Light-

Fig. 5 (François). Stippled epiphyses. Upper limb (shoulder and elbow).

wood, 1931; Kwerch, 1950), ichthyosis (Contradi, 1914; Hässler and Schallock, 1953; Jeune et al., 1953; Armaly, 1957; obs. pers., 1959), desquamating dermatitis (Burckhardt, 1938), adherence of the palmar skin to the deep layers (Bateman, 1936), hair anomalies: few and rudimentary hairs, eyebrows and eyelashes (Lund, 1942; Jeune et al., 1953; obs. pers. 1959).

2. *Craniofacial anomalies.* Microcephaly (Hässler and Schallock, 1949; Schönenberg and Schallock, 1953), megacephaly (obs. pers., 1959), saddle nose (de Toni and Papio, 1948; obs. pers., 1959), aplasia of the mandible (obs. pers., 1959), cleft palate.

3. *Congenital cardiopathies.* Interauricular and interventricular communication (Schönenberg and Schallock, 1953), truncus arteriosus (Tisdall and Erb, 1924), persistent ductus arteriosus (Lightwood, 1931); Roger's disease (Borovsky and Arendt, 1944).

4. *Other malformations* have also been noticed: clubfoot, acromicria, syndactyly, camptodactyly, kyphosis (obs. pers., 1959), wedge vertebrae, renal malformations, wolf's maw (gueule de loup), and so forth.

5. *General debility.* Gastrointestinal disturbances, as well as mental retardation.

6. The *congenital cataract* is, after all, the sign which interests us most of all. It has been observed in 50 percent of the cases and consequently has great diagnostic value. It has never been found in ordinary achondroplasia.

The cataract is bilateral, usually total, sometimes nuclear (obs. pers., 1959), with radial opacities. It is usually congenital but may, in exceptional cases, develop during the first year of life (in Bloxsom and Johnston's case [1938], at the age of 11 months; in de Toni and Papio's case [1948], at 4.5 months). In a single case (Jolly, 1951), it was unilateral.

It has been described by Contradi (1914), Lightwood (1931), Bateman (1936), Bloxsom and Johnston (1938), Maitland (1930), Lund (1942), de Toni and Papio (1948), Ford et al. (1951), Jolly (1951), Scott (1952), Jeune et al. (1953), and Armaly (1957).

On the other hand, it is probable that the cataract has not been perceived in a number of cases because an ophthalmologic examination has not always been carried out.

Fig. 6 (François). Stippled epiphyses. Shoulder.

Fig. 7 (François). Stippled epiphyses. Left knee.

Hervouet has been kind enough to lend us microphotographs of a cataract in a child with stippled epiphyses (figs. 10 and 11). They show diffuse degeneration of the lens fibers; at the anterior pole is a homogenized area; globules extricated from the fibers are between the lens and the capsule.

Congenital cataract is exclusively observed in the complete form with definite chondrodystrophy and rhizomelic micromelia. This fact lends it a prognostic value, because in nearly all the cases where is was found, except those of Jeune and his colleagues (1953) and Armaly (1957), death ensued before the age of two years.

In the cases with cataract, skin changes are the most frequent.

In the incomplete or minor, almost purely radiologic form, cataract has never been established.

In three cases, discission of the cataract was performed. In the case of Bloxsom and Johnston (1938), a dense and opaque membrane had formed; in those of Jeune and his colleagues (1953) and of Armaly (1957), the result was satisfactory.

Other ocular anomalies observed were bilateral optic atrophy in two cases (Jolly, 1951); partial, unilateral cataract; cataract absorbed after discission (Armaly, 1957). In this last-mentioned case, the retina had a granular aspect.

### Heredity

The frequency of fetal epiphyseal calcinosis is estimated at one in 500,000 (Schönen-

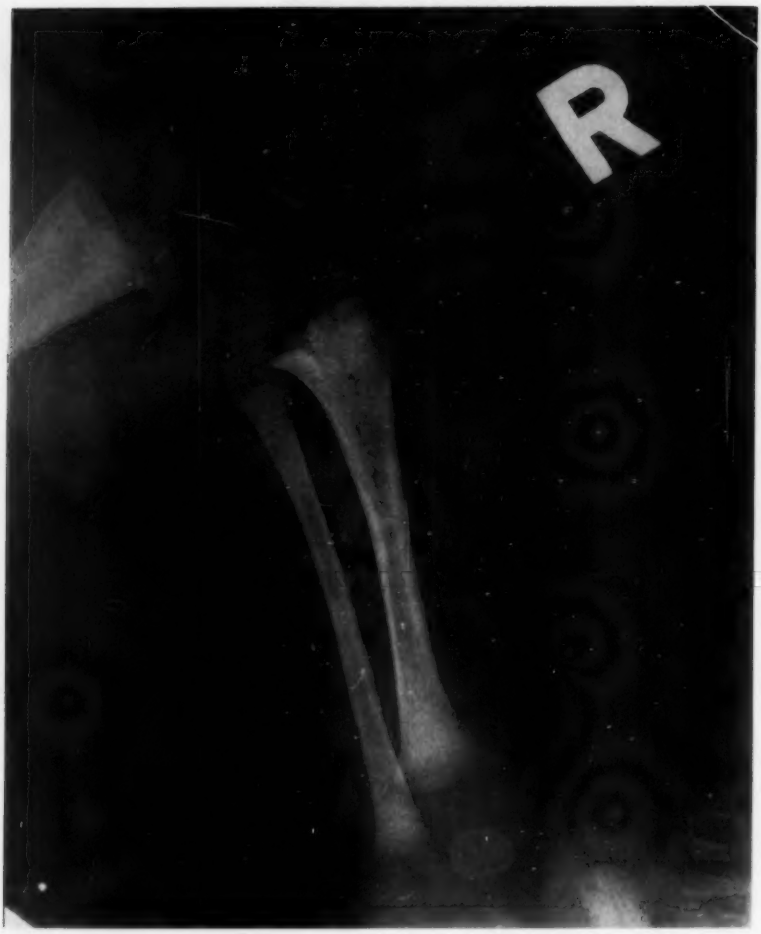


Fig. 8 (François). Stippled epiphyses. Right knee and foot.

berg and Schallock, 1953).

Girls are more often affected than boys (4:3); the female predominance is even more marked in the cases with congenital cataract (4:1).

A concordant manifestation in the two partners of a pair of identical twins was observed by Resnick (1943). This fact speaks definitely in favor of a genetic factor, especially since three instances of familial cases in siblings are known: complete form in two sisters (Maitland, 1939); minor form in four brothers and sisters (Raap, 1943); minor form in a brother and a sister (Vinke and Duffy, 1947). Among siblings the clinical form is always the same.

If, on the other hand, it is considered that consanquinity of the parents is relatively frequent (Tisdall and Erb, 1924; Lightwood, 1931; Bateman, 1936; de Toni and Papio, 1948; four out of 12 cases according to Fraser and Scriver, 1954, 33 percent), simple recessive heredity has to be assumed.

It should, however, be borne in mind that Bateman (1936) found brachymelia of the humerus in the mother and the grandfather;

Fig. 9 (François). Stippled epiphyses. Right knee.

Hünermann (1931), brachymelia of the femur in the father. Resnick (1943) observed an incomplete form of the disease in the mother. Maitland (1939) and Jorup (1944) found digital anomalies resembling those of the dysplastic children in one of the ancestors. These cases, to which we may add a personal case, demonstrate the possibility of direct transmission, in particular since the regressive nature of the epiphyseal calcifications and of the brachymelia makes it unlikely that clinical or radiologic signs will be found in the ancestors.

### 1. Bonnevie-Ullrich syndrome

The syndrome of Bonnevie (1935) and Ullrich (1930) is comprised of a great number of congenital symptoms, of which the whole or a part may be discovered in varying combinations. These symptoms may be unilateral (asymmetrical form) or bilateral (symmetrical form):

1. The principal symptom is *pterygium colli*, a broad cutaneous fold which extends from the mastoid to the acromion and is accompanied by horizontal cutaneous pads on the nape of the neck, which is short and thick. One may also find pterygiums at the joints, especially at the elbows and knees, causing anomalies in the position of the limbs and limitation of their movements.

2. There is a *laxity and hyperelasticity of the skin.* The skin is not adherent to the subjacent planes in certain places, most often the neck and the buttocks (cutis laxa).

3. There exists a *generalized muscular hypotonia* with atrophy of certain muscles,

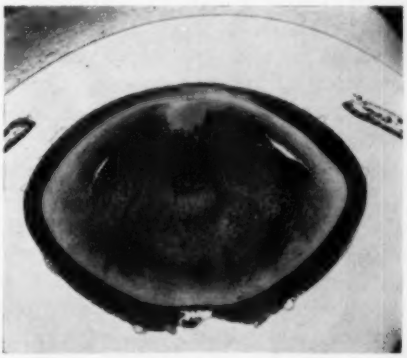

Fig. 10 (François). Congenital cataract with stippled epiphyses. Diffuse degeneration of lens fibers (Hervouet).

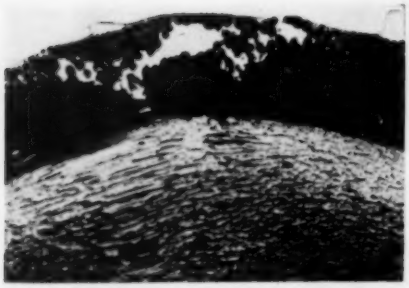

Fig. 11 (François). Congenital cataract with stippled epiphyses. Anterior pole. (Hervouet.)

most often of the pectorals, as well as a hyperlaxity of the ligaments.

4. One also notices a *hypertrichosis*, especially of the face and thorax, as well as a low implantation of the hairs.

5. A *facial paralysis* and ocular paralyses (especially of the sixth nerve) are not rare.

6. During the first years there is a *lymphangiectatic edema* especially on the backs of the extremities and in the neck.

7. *Disturbance of skeletal development* with dyscrania and nanism is frequent.

a. There exists a dyscrania with enlargement of the fontanelles and separation of the sutures. The base of the cranium is strongly sloping, which gives rise to a low position of the auricle and the external auditory canal. The digitiform impressions are often pronounced.

b. The face also presents anomalies: hypertelorism, epicanthus, ptosis, flattening of the root of the nose, cup-shaped depression of the point of the nose, hypoplasia of the mandible, arched palate, harelip or wolf's maw (gueule de loup). The dystrophic aspect of the face, together with the pterygium colli, gives the patient a "sphinx's head."

c. One may note anomalies of the foot (clubfoot), or of the hand (syndactyly, clinodactyly, camptodactyly, arachnodactyly, interdigital webbing). The nails are dystrophic, brittle, spoon-shaped (koilonychia). It is not rare to see a cubitus valgus, a subluxation of the radial head, or a dislocation of the hip.

d. The thorax is funnel-shaped and the nipples are far apart.

e. Radiographic examination shows a broadening of the epiphyses with mushroom deformity.

8. One often notices a *slight mental backwardness* with psychomotor retardation.

9. *Other anomalies reported:* umbilical hernia, situs inversus, congenital cardiopathies, duodenal stenosis, malformations of the external genital organs (hypospadias in the boys, over-development of the clitoris in the girls).

10. In women affected by the symmetrical forms, one may also observe an *ovarian agenesia* with hypersecretion of the gonadstimulins (Turner's syndrome, 1938).

The infantilism which results may be dissociated; the sexual characteristics dependent on the estrogens (breasts, labia minora, vagina, uterus) remain infantile, while the sexual characteristics which depend on the androgens (labia majora, hairs of the axilla and pubis) develop. There is a primary amenorrhea. Chromosomal determination of the sex gives a "masculine" result in patients whose sex is apparently feminine.

11. *In addition to the ocular anomalies* already pointed out, one may note an absence of the caruncle, a hypoplasia of the lacrimal glands, an exophthalmia, pigmentary anomalies of the retina and, especially, a congenital cataract (Beyer et al., 1956).

The pathogenesis of the affection has not yet been established, but, although an environmental cause cannot be excluded, certain observations favor an hereditary factor:

1. *Predominance* in members of the feminine sex is obvious: there are four women affected to one man (Ullrich, 1950).

2. Liebenam (1938) observed a *Bonnevie-Ullrich status*, unilateral and mirror-image, in a pair of monozygotic twins. Ostertag and Spaich (1936) noticed a typical syndrome in one of a pair of univitelline twins, with digitiform impressions and a web between the second and third toes in the other.

3. *With regard to family observations,*

Teveli (1930) saw a web between the third and fourth toes of the father of an affected child. Kieser (1939) noticed a pterygium colli in 10 members of one family (three generations). Baumann (1945) observed three first cousins with a congenital angiectatic lymphedema. Rossi (1945) published the report of a case of Bonnevie-Ullrich's syndrome in which a hypertelorism existed in the maternal line, and a polydactyly in the paternal line. Rossi and Howald (1947) described two sibships: several of the members of one of these families were affected by a status dysraphicus rather than by a status Bonnevie-Ullrich, while in the other a woman and her paternal female cousin presented a typical Ullrich syndrome. Cotterman (1948) reports strabismus and an epicanthus in the brother, mother and maternal male cousin of an affected subject. Foucar (1948) observed in two sisters a syndrome of Klippel-Feil, rather than of Bonnevie-Ullrich.

Wertheman and Reiniger (1949) report the case of a mother who gave birth to two stillborn fetuses with the affection and a third child, born at term, with a congenital cardiopathy. Cotterman and Falls (1950) observed the syndrome in two sisters.

It is difficult to draw conclusions of a definitive nature from these observations, but it certainly seems that the gene in question presents an irregular dominance with incomplete penetrance and variable expressivity.

### VI. Dyscephaly with bird-face and dental anomalies, nanism, hypotrichosis, cutaneous atrophy, microphthalmia and congenital cataract

Based on 24 reports in the literature, described under various names, and on two personal observations, to which we are now able to add two others (Larmande, 1959), we have described a syndrome (1957, 1958, 1959) which is characterized by seven essential symptoms.

1. *Dyscephaly,* which comprises, on the one hand, a dyscrania and, on the other, a mandibulofacial dysmorphia:

Fig. 12 (François). Brachycephaly with platybasia.

a. The dyscrania consists sometimes of a scaphocephaly, with the cranium shaped like the keel of a ship with protruding forehead. Often we see a brachycephaly with platybasia. Scaphocephaly was observed by Aubry (1893); the brachycephaly with platybasia by Hallermann (1948), Marchesani (1949), Ullrich and Fremerey-Dohna (1953), Nizetic (1954), Leffertstra (1956), Larmande (1959), and by us (two cases, 1959, fig. 12). An occipital budging was noticed by Bergmeister (1911) and by Ludwig and Korting (1950); a frontal bulge (prominence of the frontal protuberances) by Schondel (1943, Case 1), Marchesani (1949), Ullrich and Fremerey-Dohna (1953), Leffertstra (1956), and Gregersen (1956); a vaulting of the parietal bones by Bergmeister (1911), Schondel (1943, Case 2), Ludwig and Korting (1950), Ullrich and Fremerey-Dohna (1953), Weyers (1954), to such a degree that the cranium took the shape of a square (Schondel, 1943, Case 1), or of a trapezium (Ullrich and Fremerey-Dohna, 1953; Weyers, 1954). The forehead is sometimes narrow, elevated and receding (Streiff, 1950; Ludwig and Korting, 1950; Leffertstra, 1957; personal Case 2); the malar bone may be

aplasic (Ludwig and Korting, 1950; Weyers, 1954).

While there is sometimes microcephaly (Moehlig, 1946; Streiff 1950, personal observations) there may also be relative hydrocephaly (Schondel, 1943, Case 1).

There are often dehiscences of the lambdoid and longitudinal sutures (Bergmeister, 1911; Moehlig, 1946; Ludwig and Korting, 1950; Ullrich and Fremerey-Dohna, 1953; Nizetic, 1954) and open fontanelles (Bergmeister, 1911; Ullrich and Fremerey-Dohna, 1953; Gregory, 1955, Case 1; personal observation 2).

Nizetic (1954) reports a thinning of the cranial box and a partial calcification of the roof of the cerebellum, accentuated digitiform impressions, a perisellar hyperostosis and an interclinoid bridge.

In our patient there was a hyperostosis around the cranial sutures and a broad synchondrosis between the sphenoid and the occipital bone.

b. The mandibulofacial malformation is characterized above all by mandibular aplasia, which is a striking feature in every case (fig. 13). Sometimes the maxilla also has a slight degree of hypoplasia (personal observations).

Fig. 13 (François). Mandibular aplasia with hypoplasia of the maxilla.

The nose is thin, tapering and pointed (Bergmeister, 1911; Schondel, 1943, Cases 1 and 2; Moehlig, 1946; Hallermann, 1948, Cases 1 and 2; Streiff, 1950; Ludwig and Korting, 1950; Ullrich and Fremerey-Dohna, 1953; Weyers, 1954; Leffertstra, 1956; Larmande, 1959; personal observations 1 and 2), accompanied by hypoplasia of the nasal bone (Weyers, 1954), which is often curved and shaped like a parrot beak (Bergmeister, 1911; Schondel, 1943, Case 1; Moehlig, 1946; Hallermann, 1948; Streiff, 1950; Leffertstra, 1956; Gregersen, 1956; Blodi, 1957, Cases 1 and 2; Larmande, 1959; personal observation 1).

The nasofrontal angle is more acute than normally (personal observation 1). The palate is generally vaulted (Schondel, 1943, Case 2; Moehlig, 1946; Streiff, 1950; Ludwig and Korting, 1950; Ullrich and Fremerey-Dohna, 1953; Nizetic, 1954; Leffertstra, 1956; Larmande 1959, personal observation). Nizetic (1954) and Blodi (1957, Case 2) have mentioned a facial asymmetry from hemiatrophy.

The dyscephaly with aplasia of the mandible and thin curved nose gives the patient a birdlike profile, especially that of a parrot (figs. 14, 15 and 16). The frequent existence of a double cutaneous chin with a central cleft contributes to giving the patient a characteristic physiognomy (Hallermann, 1948, Case 2; Streiff, 1950; Gregersen, 1956, Case 2; Blodi, 1957, Case 2; Larmande, 1950; personal observations 1 and 2).

2. *The dental anomalies* are, so to speak, constant: some of the teeth may be lacking (Bergmeister, 1911; Blodi, 1957; Larmande, 1959; personal observation, fig. 17); those that are present are often malformed (Moehlig, 1946; Hallermann, 1948, Cases 1 and 2; Nizetic, 1954; Gregory, 1955; Larmande, 1959) or irregularly implanted (Aubry, 1893; Schondel, 1943, Cases 1 and 2; Moeh-

Fig. 14 (François). Dyscephaly with aplasia of the mandible and thin curved nose give the patient a birdlike profile.

Fig. 15 (François). A double cutaneous chin with a central cleft contributes to the characteristic physiognomy.

Fig. 16 (François). A patient of Larmande.

lig, 1946; Marchesani, 1949; Streiff, 1950; Ludwig and Korting, 1950; Blodi, 1957; Larmande, 1959; personal observation). It is not rare to observe an open bite (Ludwig and Korting, 1950; Larmande, 1959; personal observation, fig. 18) or a hiatodontia (Weyers, 1954). Caries are frequent and early (Schondel, 1943, Cases 1 and 2; Moehlig, 1946; Nizetic, 1954; Leffertstra, 1956).

3. *Harmonious and well-proportioned nanism* is reported in 20 cases out of 27, body height being 11 to 24 cm. below the normal (fig. 19). In six cases the height is not given (Aubry, 1893; Hallermann, 1948, Case 2; Marchesani, 1949, Cases 1 and 2; Ludwig and Korting, 1950; Ullrich and Fremerey-Dohna, 1953). Only one report (Weyers, 1954) specifically mentions absence of nanism. This nanism is accompanied with a retardation in skeletal development (personal observation).

4. *Hypotrichosis* is absent only in Nizetic's

Fig. 17 (François). Dental anomalies are present.

Fig. 18 (François). Illustrating an open bite.

case (1954). It exists in all the other cases. It involves the axillary and pubic hair (Leffertstra, 1956; personal observation) as well as the hairy skull, eyelashes and eyebrows (figs. 20, 21 and 22).

The hair is fine, thin, clear, rarely whitish

Fig. 19 (François). Body height is below normal.

Fig. 20 (François). Hypotrichosis.

(Schondel, 1943; Gregory, 1955) and generally absent in places (alopecia areata). The bald patches are often localized on the forehead (Marchesani, 1949; Blodi, 1957, Case 2), on the posterior and temporal aspect of the skull (personal observation 1), or along the cranial sutures (sutural alopecia: Aubry, 1893; Bergmeister, 1911; Ullrich and Fremerey-Dohna, 1953; Weyers, 1954).

The hairs in the eyebrows are thin and scattered, and sometimes completely lacking (Schondel, 1943, Case 1; Gregory, 1955; Blodi, 1957, Cases 1 and 2; personal observation 2). The eyelashes are short, fine, few in number, and sometimes absent (Schondel, 1943, Case 1; Moehlig, 1946; Weyers, 1954).

Fig. 21 (François). Hypotrichosis (patient of Larmande).

Fig. 22 (François). Hypotrichosis (patient of Larmande).

5. *Cutaneous atrophy* usually involves the head only. The skin is thin, white, dry, soft, taut, sclerous and veined. (Aubry, 1893; Schondel, 1943, Cases 1 and 2; Moehlig, 1946; Weyers, 1954; Gregory, 1955; Gregersen, 1956; Blodi, 1957; Larmande, 1959; personal observation 2.) Cutaneous atrophy is particularly marked on the nose and is often confined to this area (Schondel, 1943, Case 2; Hallermann, 1948, Cases 1 and 2; Streiff, 1950; Ludwig and Korting, 1950; Ullrich and Fremerey-Dohna, 1953; Nizetic, 1954; Larmande, 1959; personal observation 1).

Hallermann (1948, Case 2) noted numerous cutaneous folds in the face; Ludwig and Korting (1950), a vitiligo on the trunk; and we, a livedo on the thighs and the popliteal spaces.

6. *Bilateral microphthalmia* was noted in 22 cases out of 27. It is not mentioned by Aubry (1893), Moehlig (1946), Nizetic (1954) or Gregory (1955, Cases 1 and 2). It is of variable degree, the corneal diameter varying from seven mm. (Schondel, 1943, Case 2; Gregersen, 1956, Case 2) to 10 mm.

7. A bilateral congenital cataract, complete or incomplete, is reported in all the cases, except that of Schondel (1943, Case 1), in which there were sequelae of uveitis.

In Gregersen's patient (1956, Case 2), no lens opacity was noted at the age of five years, but at the age of 15 years there was a spontaneous absorption of the lens with membraneous conversion of both lenses.

The congenital cataract is generally constituted by liquefied lens masses, discission of which gives rise to the outflow of a milky-white fluid (Bergmeister, 1911; Ullrich and Fremerey-Dohna, 1953; Leffertstra, 1956; Gregersen, 1956; personal observation 1).

Spontaneous absorption of the lens on the other hand is a relatively frequent phenomenon (Hallermann, 1948; Gregersen, 1956; Case 2; Blodi, 1957, Case 1; personal observation 2).

In addition to microphthalmia and congenital cataract, other ocular anomalies have been reported that are less important or rarer; blue sclera (Schondel, 1943, Case 2; Moehlig, 1946; Ludwig and Korting, 1950; Weyers, 1954; Nizetic, 1954); distichiasis (Blodi, 1957, Case 1); ptosis (Ludwig and Korting, 1950); antimongoloid slanting of the palpebral fissures (Ludwig and Korting, 1950; Ullrich and Fremerey-Dohna, 1953; Blodi, 1957, Case 1); notching of the edge of the outer third of the lower eyelid (Ludwig and Korting, 1950); corneal vaulting (Gregersen, 1956, Cases 1 and 2), atrophy of the iris (Ludwig and Korting, 1950); posterior synechias (Ullrich and Fremerey-Dohna, 1953), floating bodies of the vitreous (Weyers, 1954), ocular hypertension (Gregersen, 1956, Case 2); changes in the ocular fundus; small disseminated pigmentations (Gregersen, 1956, Case 1), foci of chorioretinal atrophy (Streiff, 1950; personal observation 1), peripapillary choroid atrophy (Hallermann, 1948; Cases 1 and 2), cherry red macula surrounded by a grayish zone (Nizetic, 1954), pale discs (Gregersen, 1956, Case 1), coloboma at the entrance of the optic nerve (personal observation 1), macular retinopathy (personal observation 2) (fig. 23). Given the feeble vision of subjects affected, it is not surprising that the majority of them have a horizontal nystagmus, rotatory or pendular, as well as a convergent or divergent strabismus.

Some general symptoms have been reported in some instances but these are exceptional: underdevelopment of the subcutaneous adipose tissues and of the musculature (Schondel, 1943, Case 1); osteoporosis (Moehlig, 1946; Nizetic, 1954); hypogenitalism with or without cryptorchism (Ludwig and Korting, 1950; Nizetic, 1954); clawhand (Main en griffe), (Nizetic, 1954); syndactyly (Gregory, 1955, Case 2); coxalgia (Gregory, 1955, Case 2); platyspondylia (Nizetic, 1954); slight mental backwardness (Moehlig, 1946; Nizetic, 1954), dysraphic signs; lordosis with or without scoliosis (Schondel, 1943, Cases 1 and 2; Ludwig and Korting, 1950; Nizetic, 1954);

spina bifida (Schondel, 1943, Case 2; Nizetic 1954); funnel thorax (Nizetic 1954), and hypothrophy of the muscles of the scapular girdle (Nizetic 1954).

### Heredity

Apparently heredity is not a factor. All the cases described in the literature are unique. No consanguinity of the parents has been reported. However, these facts do not necessarily exclude a hereditary factor. In point of fact, it may be a question either of a recessive affection or of a mutation.

As the patients have no descendants so far as is known at present, it is impossible to come to any conclusion. Nevertheless, the identical morphologic features of all the subjects affected is strongly in favor of a hereditary factor. This is all the more likely as concordance in the two members of a couple of identical twins has just been observed (Waardenburg, 1958). Larmande (1959) has also observed several cases in one family.

## VII. Congenital hemolytic icterus

This affection is characterized by an icterus with splenomegalic anemia. The icterus is due to a massive destruction of the erythrocytes during hemolygic crises. Hematologic examination shows a microspherocytosis, a reticulocytosis, and a diminution of the osmotic resistance of the red cells. There are skeletal alterations; osteoporosis, thinning of the cortex of the bones, and protrusion of the frontal and parietal bones. Gänsslen (1940) has drawn attention also to an oxycephaly, apparently existing in 50 to 60 percent of cases. There exist *formes frustes* or latent cases characterized by an abnormal fragility of red cells (Gänsslen, 1940; Race, 1942). Splenectomy is a very effective treatment.

Ocular manifestations are not exceptional. Narrow or mongoloid palpebral fissures, microphthalmia, heterochromia of the iris, myopia, a dyschromatopsia and congenital cataracts have been reported.

The heredity of congenital hemolytic icterus is shown by its concordant manifestation in identical twins (Debre et al., 1937; Culbreath, 1937; Debre et al., 1945).

Fig. 23 (François). Macular retinopathy.

The affection is dominant with irregular penetrance (Campbell and Warner, 1926; Race, 1942; Gasser, 1951; Young et al., 1951; Bernard et al., 1952).

## VIII. Sjøgren's syndrome

In 1935 Sjøgren drew attention to the frequent association of congenital cataract and oligophrenia—one might even speak of a veritable correlation between them.

1. *The congenital cataract* is always bilateral, generally zonular, sometimes polar or total. Franceschetti and Brugger out of 18 cases found a zonular cataract 11 times, a total cataract four times, an anterior polar cataract twice, and once a posterior cortical cataract. When the cataract is partial, it often happens that it develops and becomes total (Dufour et al., 1954). It is not always strictly congenital, but exceptionally may develop in the course of the first months or years of life (Dufour et al., 1954).

2. *Oligophrenia* comprises not only mental weakness, but also imbecility and idiocy.

Sjøgren found the combination of the two affections in 44 cases in 30 families, and has shown that it is a true clinical entity. Waardenburg (1919) and others had already pub-

lished similar cases, but after Sjøgren's work the number of observations multiplied (von Hofe 1936, five cases; Heuyer, et al., 1941; Rochat, 1941; Falls, 1943; Franceschetti and Brugger, 1944, 36 cases; Krause, 1946; Heuyer et al., 1947; Guillaumat et al., 1948; Bagley, 1949; Spitzer and Mann, 1950; Pfändler, 1950; Schachter, 1950; Cordes, 1951; Euziere et al., 1951, two cases; Gursdorf et al., 1952; Christiane Vignier, 1952; Dufour et al., 1954, 14 cases; personal observation).

Madame Schappert-Kimmijser (1958) found an oligophrenia in 18 children out of 75 blinded by congenital cataract (24 percent) and in seven out of 88 children who were amblyopic because of congenital cataract (eight percent).

Mental retardation often does not manifest itself until the child is aged four years or more (Krause, 1946). It was sometimes believed that this retardation was due to the absence of vision. Although it is certain that some patients improve both from the mental and intellectual point of view after a successful operation, it nevertheless remains true that the greater part of the physical deficiency persists (Falls, 1943). Moreover, we all know of congenitally blinded persons who develop quite normally from the mental point of view.

Sjøgren's syndrome may be associated with other ocular and general anomalies:

1. *Similar ocular anomalies:* nystagmus, microphthalmia (in about 12 percent of cases), more rarely with megalocornea, myopic choroiditis, detachment of the retina. optic atrophy, keratoconia, ectopia of the lens (Franceschetti and Brugger, 1944; Pfändler, 1950).

2. *Other anomalies of a general nature:* Scheuermann's disease (juvenile vertebral epiphysitis, epilepsy, arachnodactylia or brachymorphia, skeletal malformations, infantile hemiplegia, deafness, cryptorchidia, spina bifida, gueule de loup (Dufour et al., 1954).

Sjøgren's syndrome is transmitted by autosomal recessive inheritance, by the intermediation of a single polyphene gene of variable expressivity, which produces a true encephalo-ophthalmic dysplasia:

1. There are no other cases in direct descent or ascent.

2. Affection of collaterals (first cousins above all) (Dufour et al., 1954).

3. The affection of several members of the same family is not rare (Sjøgren, 1935; Franceschetti and Brugger, 1944; Dufour et al., 1954). The risk for first cousins of affected subjects appears to be about 16 percent (Sjøgren, 1935).

4. Consanguinity of the parents is frequent: the percentage is probably about 6.7, according to Franceschetti and Brugger (1944) and 14 percent according to Dufour and his colleagues (1954), whereas the percentage for the general population does not exceed 1.5.

5. In view of the fact that women are affected as well as men (18:26, according to Sjøgren, 1935), a heredity bound to sex can be excluded.

## IX. Syndrome of Marinesco-Sjøgren

Another syndrome, much rarer than that of congenital cataract and oligophrenia, is characterized by the combination of congenital cataract, spinocerebellar ataxia and mental retardation.

Marinesco and his colleagues (1931) were the first to draw attention to this new clinical entity, which they observed in four first cousins of a sibship of six. In 1947 and 1950 Sjøgren made a thorough clinical and genetic study of this syndrome. He was able to collect 14 cases, distributed throughout six families. Since then, other observations have been published: Garland and Moorhouse, 1953; Dufour and his co-workers, 1953, one case; Franceschetti and his colleagues 1956, one case.

The spinocerebellar ataxia may be replaced by a spastic diplegia (Sjøgren, 1950) or by the peroneal muscular atrophy of Charcot-Marie-Tooth (Dufour et al., 1954),

affections within the frame of ataxias from spinopontocerebellar degeneration.

Richards (1950) has published the report of a case similar in some respects but, nevertheless, very different from the neurologic point of view.

The syndrome of Marinesco-Sjøgren may be associated with other congenital anomalies, more particularly anomalies of the skeleton: short stature, scoliosis, genu valgum, limitation of extension movement of the knee joints, anomalies of the fingers and toes, retardation of somatic development.

The syndrome is hereditary and is transmitted by the autosomal recessive mode. Consanguinity of the parents is also frequent (Sjøgren, 1950; Garland and Moorhouse, 1953; Franceschetti and colleagues, 1956). Marinesco and his colleagues observed the syndrome in four first cousins; Garland and Moorhouse (1953), in two cousins who were the offspring of marriage of two sisters with their first cousins once removed. Certain observations of Sjøgren (1950), however, do not exclude the possibility of an occasional dominant transmission.

## X. Mongolism

The principal signs of mongoloid idiocy (fig. 24) are the following: both physical and mental retardation; small stature; flat, round and mongoloid face; saddle nose; thick and fissured lower lip; large, scrotal tongue; reduction of the anteroposterior diameter of the skull; absence of the frontal sinuses; abnormal development of bones of the face and skull; short and stocky limbs; soft and seborrheic skin; thick, smooth hair; obesity; genital insufficiency; muscular hypotonia and great looseness of the joints; very pronounced psychic disturbances.

In the eye one notes hypertelorism and narrow palpebral fissures which run obliquely downward and inward. There is frequently an epicanthus. The free edge of the upper eyelid is strongly arched. The stroma of the iris is very thin and presents a characteristic mottled appearance. There is often a convergent squint and nystagmus.

Fig. 24 (François). Mongolism.

More than half of the patients with mongolism have cataract, which is sometimes evolutive. In a third of the cases a high degree of myopia is present.

Four types of ocular opacity are distinguished in these patients:

1. *Arcuate opacities* astride the equator of the fetal nucleus. The opacities, often thin and narrow, are sometimes fairly wide, thus occupying an important sector. Sometimes they constitute a true zonular cataract. They may be divided into two parts and separated by a thin layer of transparent fibers.

2. *Opacities of the embryonic sutures.*

3. *Various congenital cataracts* (polar, posterior).

4. *Acquired opacities,* similar to cerulean cataract (Pearce, Rankine and Ormond, 1910; Ormond, 1911-1912; van der Scheer, 1919; Vontobel, 1933; Bucklers, 1939).

In examining 52 mongols, Lowe (1949, 1950) found arcuate opacities eight times, sutural opacities 14 times, a disc-shaped cataract once, a zonular cataract once, and a

posterior polar cataract once—25 congenital cataracts.

Skeller and Oster (1951) reported that in 32 mongols they found eight eyes with arcuate opacities, 10 eyes with sutural opacities, and 11 eyes with various congenital cataracts; that is, 45 percent of the eyes with congenital cataracts. They found 45 eyes with acquired opacities (70 percent). Igersheimer and Mautner (1951) among 165 mongols found eight percent with congenital cataracts. Other authors also have reported congenital cataracts or opacities: Cassel (1917, three cases out of 60 mongols), van der Scheer (1919, two cases of zonular cataract out of 90 cases of mongoloid idiocy), Chotzen (1925), Elschnig (1932), Vogt (1933), Vidal Freyre et al. (1936), Scatena and Gallo (1941), Spitzer and Mann (1950).

The pathogenesis of mongolism is still a very controversial subject. Generally, advanced age of the mother at the moment of conception is invoked as the cause. There are, however, some arguments in favor of the intervention of a predisposing hereditary factor, transmitted with simple recessivity:

1. According to Schroeder (1939), the incidence is as high as 88 percent in monozygote twins and only eight percent in dizygotes. Benda (1949) found an incidence in seven cases out of seven pairs of monozygote twins against four cases out of 25 pairs of dizygote twins; Gedda (1951), in 26 cases out of 28 pairs of monozygotes against four cases out of 60 pairs of dizygotes; Jervis (1953), in 20 cases out of 20 pairs of monozygotes against four cases out of 62 pairs of dizygotes; Allen and Kallmann (1956), in three cases out of three pairs of monozygotes against no case in 23 pairs of dizygotes.

Although cases of discordance have been reported in monozygote twins (Orel, 1931; Oster, 1953; Friedman, 1955; Van Beukering and Vervoorn, 1956), it may be said that concordance is the rule among monozygotes (nearly 100 percent according to Allen and Kallmann) and the exception among dizygotes (four percent according to the same authority). We have had the opportunity to observe a pair of univitelline female twins, age one and one-half years, both of whom presented a mongoloid idiocy with erythremia and albinism.

2. There exist familial cases, with affection of several members of the same sibship: Portius (1941) found 15 such in 460 mongolians; Böök and Reed (1950) observed four cases of monogolism among 271 first cousins of 63 mongolians; Turpin and Lejeune (1953) saw four mongolian brothers and sisters out of seven members of a sibship; Oster (1956) found 30 familial cases out of 526.

Consanguinity of the parents, however, is not frequent: 1.2 percent according to Portius (1941), and 0.57 percent according to Oster (1956).

3. Lejeune, Gautier and Turpin (1959) have demonstrated that in mongolism there exist 47 chromosomes instead of 46 (irisomia).

## XI. Syndermatotic congenital cataracts

Certain cutaneous affections such as poikiloderma infantilis of Zinsser-Thomson (Rothmund's syndrome), congenital dyskeratosis (Schafer's syndrome), congenital ichthyosis, congenital atrophy of the skin (Siemens' syndrome) and patchy pigmentary dermatosis (incontinentia pigmenti) are often accompanied by a congenital cataract.

Of course we are not speaking here of acquired syndermatotic cataracts (scleropoikiloderma of d'Arndt-Jaff, the syndrome of Werner, Besnier's prurigo).

### Rothmund's syndrome

Rothmund's and Werner's syndromes have been confused for a long time; it is only in recent years that the two affections have been separated in a precise manner. Whereas the syndrome of Werner begins after puberty, that of Rothmund begins in the course

of the first year of life, generally between the third and sixth months, by a cutaneous eruption of exanthematous type. It is relatively rare, as only about 25 cases are known.

It is characterized by three symptoms: dermatosis, cataract, and hypogenitalism.

1. *Dermatosis.* The eruptive and exudative lesions develop toward cicatrization and sclerosis to constitute a poikiloderma of the infantile type of Zinsser-Thomson (figs. 25 and 26). Three kinds of lesions are distinguished:

a. Zones of atrophy and of sclerosis, giving to the palpating finger the impression of cigarette paper.

b. Telangiectases, the color of the lees of wine, which predominate in the immediate vicinity of the cicatricial zones.

c. Derangements of pigmentation: depigmented and hyperpigmented areas situated outside the atrophic zones and more especially on the trunk.

The cutaneous alterations are mainly found on the face, ears, forearms, hands and legs.

Disturbances of the phanera (hair, nails, etc.) are added to the cutaneous lesions:

Fig. 25 (François). Rothmund's syndrome (after Habermann and Fleck, 1955).

Fig. 26 (François). Rothmund's syndrome (after Seefelder, 1935).

a. Alterations of the pilary system: the hair falls out and becomes thin (alopecia or early baldness); the eyelashes and eyebrows are thin and sometimes absent.

b. Dystrophy of the nails; shortened, striated or atrophied nails, associated with an acromicria (small hands and fingers).

It is not uncommon to see dental anomalies (Bloch, 1926; Jackli 1939; Cole et al., 1945).

Finally, attention may be drawn to the nose, which is small, saddle-shaped and pale; the skin there is particularly atrophic and traversed by very fine telangiectases.

2. *Cataract.* This cataract of the endocrine type generally begins when the child is between the second and fourth year of age. It is always bilateral and evolves rapidly in a few weeks or months. It may be congenital and of the zonular type, as in the cases of Cole and his colleagues (1945).

Exceptionally, there is no opacity of the

lens (Habermann and Fleck, 1955, two cases).

Degenerative lesions of the cornea have also been reported: Rothmund (1869) and Seefelder (1935); Strebel (1913), Bloch and Stauffer (1929); Schnyder (1935) and Maeder (1949).

3. *Hypogenitalism.* The endocrine disturbances which commence with the onset of puberty are generally reduced to a hypoplasia of the internal and external genital organs, with amenorrhoea in the woman and testicular atrophy in the man. Bloch and Stauffer (1929) observed an adiposogenital syndrome. In the cases of Jackli (1939) and of Miescher (1941) there was a nanism.

Habermann and Fleck (1955) observed a disturbance of enchondral ossification, both epiphyseal and metaphyseal, in a brother and sister, both of them affected by the condition.

*Heredity.* The syndrome of Rothmund is much more frequent in women than in men. Out of the 24 cases collected by Maeder (1949), there were 19 women and five men; the difference is significant (X2:7).

The affection is always observed within the same sibship (Rothmund 1868, three sibships, with, respectively, four first cousins affected out of seven, two out of six, and two out of three; Siegrist-Lutz 1928, two first cousins affected out of four; Seefelder, 1935, three first cousins affected out of six; Cole et al., 1945, two first cousins out of two, Maeder, 1949, four first cousins affected out of 10).

Consanguinity of the parent is, moreover, reported in four cases (Rothmund, 1868, two cases; Seefelder, 1935; Guillaumat and Maeder, 1949; Habermann and Fleck, 1955).

It may therefore be concluded that there is an autosomal recessivity.

### Schafer's syndrome

This syndrome consists of a congenital dyskeratosis associated with a congenital cataract. Depending on a dominant hereditary factor, it has the following characteristics:

1. A *palmoplantar keratosis* (fig. 27) with hyperhidrosis, a disseminated follicular hyperkeratosis of the skin, and a leukokeratosis of the buccal mucosa.
2. Small foci of *cicatricial alopecia.*
3. A *pachyonychia:* very thick nails resting on a tissue like the pith of a reed.
4. A *retardation of development* (microcephaly and nanism) with oligophrenia and hypogenitalism.
5. A *congenital cataract.*

### Congenital ichthyosis

Congenital ichthyosis or congenital ichthyoform erythrodermia of Brocq (1902) consists of a diffuse erythema more or less thick, in patches or sheets, diffuse or generalized. The hyperkeratosis especially involves the articular folds (figs. 27 and 28), the palms and the soles. Here, may be no-

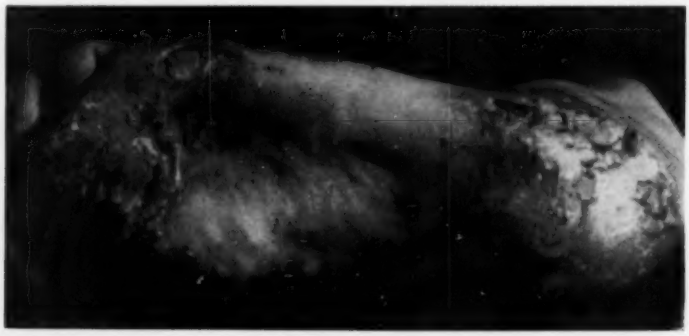

Fig. 27 (François). Keratodermia of the soles (after Graciansky and Boulle, 1952).

ticed, a simple dryness of the skin with fine desquamation, but also masses, cornified, yellowish or amber, villous and macerated or black and dry, often arranged in linear series in the axillae, irregular and cut by deep fissures, painful, bleeding and malodorous on the palms and soles (Graciansky and Boulle, 1952).

Erythema is frequent, although not always present. It may be generalized, especially in the child, or localized to certain regions. It is easily seen through the rather thin, smooth, shining, cracked, and collodion-like hyperkeratosis of the face and, above all, in the form of a keen red edge a few mm. wide, on the outer borders of the sheet of hyperkeratosis of the soles and palms. Hyperhidrosis and sebaceous secretion are usual, as well as the hyperepidermatropia, which is evidenced by the exaggerated growth of the nails and hairs. The affection, which presents a heredity that is generally recessive and often with consanguinity of the parents (Adrian, 1906; Siemens, 1929; Gottron, 1933; Cockayne, 1933), may be accompanied by a *congenital cataract* (Siemens, 1929).

Fig. 28 (François). Congenital ichythyoform hyperkeratosis (after Graciansky and Boulle, 1952).

### Siemens' syndrome

Siemens (1929) described the association of a congenital cataract and a congenital atrophy or hypoplasia of the skin (fine, somewhat transparent skin easily falling into folds, fragile, lacking fat, slightly shaggy and poor in sudoriparous glands).

The affection is hereditary and the transmission is simple recessive: six cases distributed among three related sibships.

### Incontinentia pigmenti

Franceschetti and Jadassohn (1954) have recently shown that two separate syndromes must be distinguished: (1) infantile pigmentary dermatosis in Bloch-Sulzberger patches and (2) reticulated infantile pigmentary dermatosis.

The latter affection, which is characterized by a slate-colored, cutaneous pigmentation of reticulated morphology, hypohidrosis or anhidrosis, a bad state of the teeth, and a palmoplantar keratosis, is not accompanied by ocular anomalies.

### Pigmentary dermatosis in patches

This syndrome, described by Bloch (1925) and Sulzberger (1926), is generally congenital or appears in the course of the first week of life (in 63 percent of cases), rarely in the course of the first year, and exceptionally after one year.

It is characterized by the following symptoms:

1. *Slate-gray cutaneous pigmentation* in patches, disposed in striae of wavy streaks and sometimes disappearing at the end of several years. Histologically, chromatophores are seen in the superficial layers of the derma with more or less complete absence of pigment in the epidermis. In two thirds of the cases the pigmentation is preceded by an acute inflammatory stage, which is often of the type of Duhring's dermatitis herpetiformis.

2. *Ocular affections*, generally of the malformation type, exist in a quarter of the cases: pseudoglioma (Haxthausen, 1945; Duke University, 1948; Uebel et al., 1950; Findlay, 1952; Bloch, Sulzberger, Franceschetti and Jadassohn, 1954; Kawamura, 1954; Watanabe, 1954; Scott et al., 1955); atrophy of the optic nerve (Moncorps-Seidlmayer, 1942; Seidlmayer-Höra, 1943; Gerard-Lapiere, 1959; Carney, 1959). Nystagmus has been reported (Haber, 1952), a strabismus (Lechleuthner-Siemens, 1929; Pierini et al., 1952), and a probable papilitis (Kühling 1949).

Fairly often a congenital cataract has been noted (Sulzberger, 1938; Jaramillo et al., 1948; Curth, 1949; Gasteiger, 1959; Ito, 1951).

3. In a quarter of the cases, *dental anomalies* have been reported (partial absence of the teeth, dental malformations, delay in dentition).

4. Also in a quarter of the cases, there is an *alopecia* of the pseudopelada type of Brocq.

*Heredity.* The first feature that catches the attention is the extraordinary predominance of the feminine sex: out of the 73 cases culled from the literature by Franceschetti and Jadassohn (1954), there are 70 women; and out of the 91 cases collected by Scott and his colleagues (1955), there are 86.

Four cases only were familial: two identical twins of Bardach (1925), two sisters of Curth (1949), two others of Kitamura and Fukishiro (1951), and two female first cousins reported by Scott and his colleagues (1955).

Consanguinity of the parents is reported only twice (Lapiere-van Bogaert-Gerard, 1947 and 1948; Kitamura and Fukishiro, 1951).

Nevertheless, it must be noted that ocular malformations have been observed in the parents of affected subjects (Sulzberger, 1938; Duke University, 1938; Franklin, 1952; Findlay, 1952; Scott et al., 1955), that sometimes an affection suspected of being incontinentia pigmenti has been reporrted in the ancestors (Sobel, 1948; Kitamura and Fukishiro, 1951), that one may often find symptoms frequently associated with incontinentia pigmenti in other members of the family (pseudopelada and dental anomalies). Franceschetti and Jadassohn (1958) believe that there may be a dominant transmission with great variability of expressivity and of penetrance.

## Conclusion

It is clear that if, in the presence of a congenital cataract whose etiology appears to us obscure, we take the trouble to make a general and systematic examination that will collect all the concomitant anomalies, we shall very often be able to refer it to one or another syndrome, and by this very fact attribute to it a genetic origin.

*De Pintelaan.*

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# A MODIFIED TECHNIQUE FOR MUSHROOM CORNEAL GRAFTS WITH A NEW INSTRUMENT*

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The technique of a combined lamellar and perforating corneal transplant, the so-called mushroom graft, in cases of badly scarred corneas with heavy vascularization was first offered in 1950 by Franceschetti and Doret.[1] More recently (1959) Stocker[2] presented another technique for the preparation of the donor graft, which is more difficult than in the recipient eye, along with the results of 13 cases. Stocker felt that the mechanical apparatus of Franceschetti and Doret very likely would cause considerable trauma to the graft and advanced a less traumatic technique. We, in turn, found difficulty with Stocker's technique for fixation of the whole excised cornea so that the unwanted portions of the donor cornea could be easily cut away. We, therefore, offer a modified technique with a new instrument† designed to fixate the donor cornea and allow excision of the mushroom graft with minimal manipulation.

## DESCRIPTION OF THE INSTRUMENT

The instrument (fig. 1) is a stainless steel double-ring, sliding-lock fixation clamp with the upper corneal ring having an outside diameter of 13 mm. and an inside diameter of 11 mm. The lower ring measures 13 mm. on the outside and has a 7.0-mm. central opening. Along the underside of the upper ring, 0.5 mm. from the inner border, project eight 1.0-mm. pins which pierce the donor tissue and are received by similarly placed holes in the lower ring.

The rings are convex-concave on their respective surfaces so as to allow fixation of the cornea without tissue distortion. The inner surfaces have fine concentric and radial serrations to aid the fixation. The clamp is easy to clean and may be autoclaved.

Fig. 1 (Keates, Martinez and Paton). Fixation clamp in open position. On this working model there are only four pins for fixation, instead of the eight which we prefer.

## TECHNIQUE

The donor eye, rolled in gauze, is grasped with one hand and a 10-mm. trephination is made to one-half the corneal thickness. Then using a Paufique angulated blade, the splitting of the lamellar portion is started as if for an ordinary lamellar graft (fig. 2). Next, the whole cornea plus 3.0 mm. of sclera is excised with knife and scissors.

At this point, or before, a 6.0 mm., 5.0 mm., or 4.5 mm. Paton-type trephine, with outside guard, is set for depth of penetration (fig. 3), taking into consideration the fact that the trephine blade will have to extend through the inferior hole while the outside guard rests against the ring. This can only be done by trial and observation.

The excised cornea is placed, epithelium up, between the rings, centering the lamellar portion (fig. 4). The clamp is then locked and turned so that the endothelial side is up. The central "stem" is cut with the present trephine (fig. 5). The clamp is again turned

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† Manufactured by Storz Instrument Company, Saint Louis, Missouri.

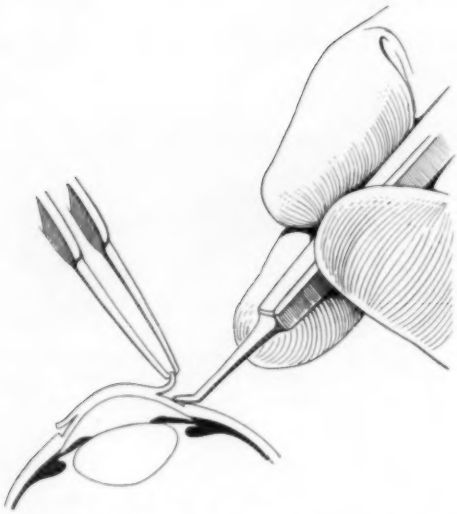

Fig. 2 (Keates, Martinez and Paton). A 10-mm. lamellar trephination to half the corneal thickness has been made and a Paufique knife is shown undermining the edges.

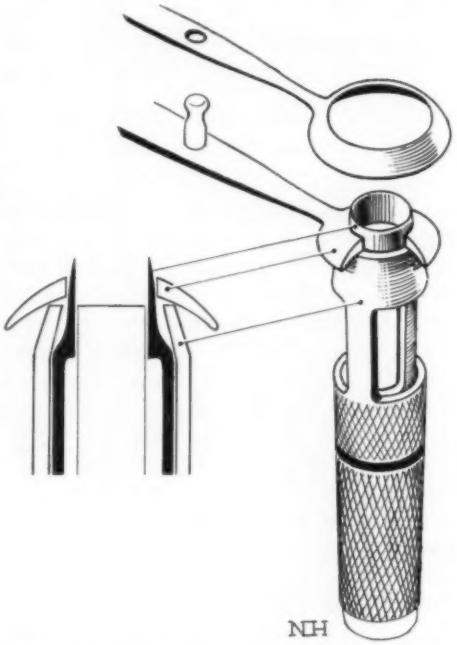


Fig. 3 (Keates, Martinez and Paton). To set the outside guard of the small trephine to the proper depth, the trephine blade is inserted into the opening of the smaller ring and adjusted so that the blade extends half the corneal thickness beyond the ring.

Fig. 4 (Keates, Martinez and Paton). After the whole donor cornea plus 3.0 mm. of sclera has been excised, the tissue is placed in the clamp, epithelial side up, centering the lamellar trephination. Here the clamp is still open.

Fig. 5 (Keates, Martinez and Paton). The clamp is closed and locked and then inverted so that the endothelial side is up, and the central "stem" is cut.

over and the already started lamellar dissection is completed to the central "stem" with a Gill knife or any appropriate blade (fig. 6). This completes the cutting of the donor graft.

The recipient cornea is prepared as described by Franceschetti and Stocker. A 10-mm. lamellar trephination and excision is followed by a 6.0-mm. central perforating trephination. The graft is then transferred to the recipient site and the lamellar portion is sutured edge to edge.

With the Paton outside-guard trephine it is easier to control accurately the depth of the central stem than it is to judge the depth by observation alone with an unguarded trephine. In the 6.0-mm. perforating section, the guard only touches the clamp and if a smaller perforating section is made, the trephine guard touches only endothelium which is to be discarded anyway.

As an alternative method the whole cornea with scleral ring may be excised first and the lamellar trephination may be performed in the clamp, but we have found it easier to judge the lamellar depth and start the splitting before excision of the whole cornea.

The indications, operative complications, and postoperative management of mushroom grafts have been thoroughly described by Stocker and will not be discussed here.

Fig. 6 (Keates, Martinez and Paton). The clamp is turned again so that the epithelium is uppermost and the lamellar section is completed to the central stem.

## Conclusions

A modified technique for the preparation of the donor graft and a new instrument for corneal mushroom grafts have been presented. This technique was developed using human Eye-Bank eyes and was found to offer a relatively easy method of preparation of clean-cut mushroom corneal transplants.

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### Addendum

Since this article was submitted for publication, a slightly modified version of the clamp has been developed, which may be used for cutting mushroom grafts and also for fixation of preserved corneas for splitting of lamellar grafts.

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## Ophthalmic Miniature

It may, however, be added that I have noticed a decided tendency to glaucomatous disease in persons who have undergone, late in life, an operation for juvenile cataract.

Sir William Bowman, "Ophthalmic Miscellanies," *Royal London Ophth. Hosp. Reports,* **5**:15, 1866.

# BLOOD CHOLINESTERASES LEVELS OF NORMAL AND GLAUCOMA SUBJECTS*

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## INTRODUCTION

The possibility of a relationship between the blood cholinesterases (ChE) levels and glaucoma has been explored in the past.[1-3] In these studies the methods employed for determining the ChE-activity have differed and the results obtained have varied. In our previous investigation, a lower level of red blood cell cholinesterases (AChE) was found in glaucoma subjects as compared to normal individuals.[3] It is generally recognized that apart from several organic diseases and various drugs which considerably influence the blood ChE picture, these values may vary widely even from one individual to the other. Thus it may be safe to assume that apart from an actual correlation between blood AChE and glaucoma, the variations in previous results might have been due to either the differences in techniques employed for determining the ChE-activity or to a mere random statistical finding. Consequently in the present study, employing another technique, the Warburg manometric technique as recommended by Augustinsson and modified by him, the blood ChE levels in a new series of normal and glaucoma subjects have been determined.[4,5] Furthermore in a limited number of patients simultaneous determinations have also been made in the same samples of blood with the titrimetric method as used in the previous study.[3] The results of the present investigation are reported here.

## MATERIALS AND METHODS

Three ml. venous blood was obtained in a heparinized tube from each of 18 normal and 15 glaucoma subjects of the outpatient department of the Wills Eye Hospital, Philadelphia, and all samples were refrigerated until analysis. *Normal subjects* were persons with no ocular pathology other than refractive error. *Glaucoma subjects* were patients of proven primary chronic simple glaucoma. None of them had any organic disorder such as blood dyscrasia, liver disease, and so forth; nor had they been receiving anticholinesterase drugs, either of which might profoundly influence the blood ChE levels.

The whole blood was centrifuged at 3,000 rpm and the plasma pipetted off in a separate tube. The blood cells were washed three times with normal saline, hemolyzed with distilled water, and the volume restored to that of the original blood sample.

The Warburg manometric technique was employed for measuring the acid production resulting from hydrolysis of the choline esters in a bicarbonate buffered system by the ChE. The procedure followed was that recommended by Augustinsson and somewhat modified by him.[4,5]

Flasks without center wells of approximately 20 ml. capacity were used, and the thermostat in the water bath was set for 37°C. The bicarbonate buffer solution (bicarbonate Ringer's solution, pH 7.4) was prepared fresh every third day by mixing 100 ml. of 0.9-percent NaCl, 30 ml. of 1.26-percent $NaHCO_3$, and 2.0 ml. of 1.76-percent $MgCl_2 \cdot 6H_2O$ and saturating with 95-percent $N_2$ + 5.0-percent $CO_2$ gas mixture. A 7.52-percent stock solution of the substrate acetylcholine was made by dissolving the

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pure salt acetylcholine iodide in HCl, pH 4.0, and was diluted four times with buffer solution, each time immediately before use. Then 2.55 ml. of buffer solution was added to the 0.05 ml. of the sample containing the enzyme (hemolysed red blood cells or plasma) in the main compartment of the flask and 0.40 ml. of the substrate solution was placed in the side-arm so that, after mixing, the total volume of the reaction mixture was 3.0 ml.

Duplicates of each sample were run in the presence of a thermobarometer to correct temperature and atmospheric pressure changes along with controls which contained the buffer and substrate solutions but no enzyme sample.

The flasks were connected to the manometers and placed in the thermoregulated water bath. The system was saturated with a 95-percent $N_2$ + 5.0-percent $CO_2$ gas mixture applied for 10 minutes and then equilibrated for 10 minutes while shaken at approximately 90 oscillations/min. The level of the thermobarometer and each successive manometer was quickly recorded, immediately after which the enzyme and substrate were mixed in each flask. Readings were then taken every 10 minutes for next 40 minutes.

TABLE 1

BASELINE BLOOD PLASMA AND RED BLOOD CELL ChE LEVELS OF NORMAL HUMAN SUBJECTS

(ChE hydrolysis of acetylcholine in terms of µl $CO_2$/30′/0.1 ml., sample corrected for autohydrolysis)

| Subject No. | Plasma | Red Blood Cells |
|---|---|---|
| 1 | 193 | 228 |
| 2 | 211 | 148 |
| 3 | 169 | 170 |
| 4 | 218 | 188 |
| 5 | 176 | 215 |
| 6 | 123 | 229 |
| 7 | 174 | 197 |
| 8 | 152 | 204 |
| 9 | 156 | 204 |
| 10 | 188 | 150 |
| 11 | 152 | 159 |
| 12 | 189 | 136 |
| 13 | 127 | 206 |
| 14 | 128 | 212 |
| 15 | 168 | 205 |
| 16 | 188 | 157 |
| 17 | 145 | 199 |
| 18 | 165 | 130 |
| MEAN AVERAGE VALUE | 168 | 185 |
| MEAN STANDARD DEVIATION | ±27 | ±30 |

TABLE 2

BASELINE BLOOD PLASMA AND RED BLOOD CELL ChE LEVELS OF GLAUCOMA PATIENTS

(ChE hydrolysis of acetylcholine in terms of µl $CO_2$/30′/0.1 ml., sample corrected for autohydrolysis)

| Patient No. | Plasma | Red Blood Cells |
|---|---|---|
| 1 | 148 | 173 |
| 2 | 215 | 198 |
| 3 | 224 | 188 |
| 4 | 166 | 167 |
| 5 | 115 | 181 |
| 6 | 185 | 160 |
| 7 | 223 | 203 |
| 8 | 163 | 165 |
| 9 | 220 | 155 |
| 10 | 137 | 166 |
| 11 | 156 | 201 |
| MEAN AVERAGE VALUE | 177 | 178 |
| MEAN STANDARD DEVIATION | ±34 | ±17 |

The amount of $CO_2$ evolved was expressed as µl. and plotted against the time in minutes. The extrapolated 30-minute values were determined by drawing a straight line through the points obtained. A value of 4.5 µl/30 min. was found for the average autohydrolysis (nonenzymatic) of acetylcholine and was subtracted from the extrapolated 30-minute value in each case.

## RESULTS

The results of the experimental data are shown in Tables 1 and 2. They indicate no statistically significant difference in the mean values of red blood cell ChE levels of normal and glaucoma subjects.

A comparison of the titrimetric method previously applied and the manometric method employed in the present study is presented in Table 3. The red blood cell ChE content of four glaucoma patients was analyzed by each method. Although the results of the two methods do not agree in absolute units, it was considered that one means of a direct comparison would be to observe the

TABLE 3

COMPARISON OF BASELINE RED BLOOD CELL ChE LEVELS OF GLAUCOMA PATIENTS AS DETERMINED BY MANOMETRIC AND TITRIMETRIC METHODS

| Patient No. | Manometric Method (ACh hydrolyzed in terms of μl $CO_2$/ 30′/0.1 ml.) | Titrimetric Method (ACh hydrolyzed in mM/hr./cc.) |
|---|---|---|
| 1 | 197 | 0.527 |
| 2 | 218 | 0.586 |
| 3 | 195 | 0.556 |
| 4 | 200 | 0.592 |
| MEAN AVERAGE VALUE | 202 | 0.565 |
| MEAN STANDARD DEVIATION | ±9 | ±0.026 |
| COEFFICIENT OF VARIATION | 4.4% | 4.6% |

range of activity of a sample population. The figures for the standard deviation in each case indicate, at least on one level, a similarity in the nature of the results.

Figure 1 incorporates all data obtained for the evaluation of plasma and red blood cell ChE activity in normal and glaucoma patients. It graphically illustrates the relatively wide range of individual values within each sample group.

The method adopted for this study lent itself to evaluation in two ways. First, it was noted that the duplicate analysis of individual samples corresponded to the degree of reproducibility characteristic of the Warburg apparatus itself. Second, the continuous

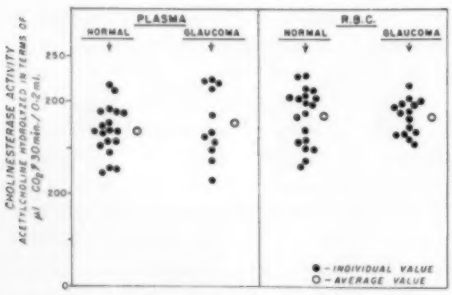


Fig. 1 (Krishna, Mann and Leopold). Comparison of baseline plasma and red blood cell cholinesterase levels in normal and glaucoma patients. (Method after Augustinsson.)

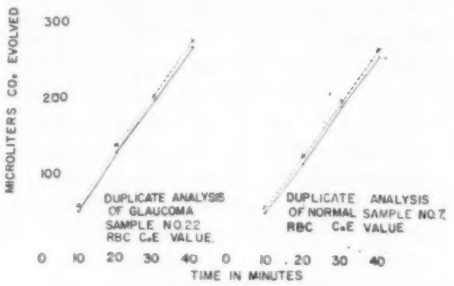
MICROLITERS CO2 EVOLVED
300
200
100
DUPLICATE ANALYSIS OF GLAUCOMA SAMPLE NO.22 RBC CoE VALUE.
DUPLICATE ANALYSIS OF NORMAL SAMPLE NO.7 RBC CoE VALUE
0 10 20 30 40 0 10 20 30 40
TIME IN MINUTES

Fig. 2 (Krishna, Mann and Leopold). ChE hydrolysis of acetylcholine in terms of μl $CO_2$ evolved /0.1 ml. expressed as a function of time in minutes. (Method after Augustinsson.)

function of the chemical environment was evidenced by the colinear nature of the points plotted for each time period. Figure 2 provides an illustration of this.

## DISCUSSION

It is worthy to note that in the chapter on assay methods for cholinesterases in *Methods of Biochemical Analysis,* Augustinsson has recommended the Warburg manometric technique as the most reliable and commonly employed method.[5]

The present study, employing this technique, has revealed no statistically significant difference in the mean values of red blood cell ChE levels of normal and glaucoma subjects. Although this is contrary to our previous observations which indicated a lower value for glaucoma patients compared to normal individuals, the inconsistency is not necessarily due to the incompatibility or specificities of the techniques employed. This is shown by the similarity of the simultaneous determinations made on the four patients in Table 3 by both the manometric and titrimetric methods. In spite of all considerations certain factors which influence blood ChE concentration might have been overlooked which could have accounted for the low value obtained in the previous study. However, in view of the wide range of variations in the blood ChE levels from one individual to another, represented in Figure 1, it appears more logical to assume that this

initially observed difference was a random statistical finding. These findings agree with those of Dienstbier who, employing McDonald's colorimetric technique as modified by Fleisher and Pope, was unable to demonstrate any statistically significant difference in the mean values of red blood cell ChE in 50 patients with various forms of glaucoma and 50 nonglaucomatous controls.[2]


## Summary

Using the Warburg manometric technique after Augustinsson, no significant difference was found in the average mean values of the red blood cell ChE levels of normal and glaucoma subjects when computed from the data obtained on 18 normal individuals and 15 glaucoma patients. From the results of this study it is believed that the low mean value for glaucoma patients obtained in a previous study was a random statistical finding without clinical significance.


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# DACRYOCYSTOGRAPHY IN CHRONIC DACRYOCYSTITIS*


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The practical application of dacryocystography is of recent interest in surgery of the lacrimal passage, where it is important for a surgeon to know beforehand (1) the effect of inflammation on the lacrimal sac; (2) the exact site of obstruction in the nasolacrimal tract; and (3) the type of block, functional or absolute.

## Review of literature

Ewing[1] in America was the first to advocate the use of radiopaque material to outline a pathologic nasolacrimal system. In 1920, Von Szilly[2] described the pathology of the tear passages as visualized roentgenographically. Several investigators employed such contrast agents as bismuth, thorium or barium to visualize the system. Sicard and Forestier introduced Lipiodol, iodized poppyseed oil, as a radiopaque material.

Hourn[3] suggested placing dental X-ray film intranasally for visualization of the nasolacrimal passageways, and Spackman[4] studied 100 patients over a period of four years.

Fox[5] presented iodized-oil studies of chronically distended tear sacs. The technique he followed was thorough irrigation and gentle massage of the sac to assure its emptiness. Then the sac was irrigated with warm lipiodol until the radiopaque material was seen to flow back into the conjunctival sac. Excess of the lipiodol was then wiped out of conjunctival sac and antero-

* This paper is based on thesis submitted to Vikram University in 1958.

posterior and lateral X-ray plates were taken within half an hour of injection.

In order to simplify his study, Fox divided his cases into three groups (I) Nonspecific chronic dacryocystitis, (II) traumatic chronic dacryocystitis with intact sac, and (III) traumatic chronic dacryocystitis with sac involvement.

Blankstein[6] used iodized oil (U.S.P.) in children and demonstrated dilated and atonic sacs in two and a sac of normal size and shape in the third. In all cases, obstruction was at the upper end of the nasolacrimal duct. The dilation of the sac was directed forward and was greater below the internal canthal ligament, as shown by Fox.[5]

Milder and Demorest[7] presented a study based upon 30 normal patients in whom ethyl iodophenylundecylate (Pantopaque) was used as a contrast agent. Normal features of the lacrimal tract were described and a standard technique for radiography was proposed.

Milder and Demorest,[8] in their second article, described some aspects of the pathologic lacrimal apparatus. They stated that, in a normal sac the radiopaque dye usually disappears within 30 minutes. When patency of the lacrimal drainage system cannot be demonstrated by routine irrigation, the preoperative use of dacryocystography is indicated to show: (1) the character of the structures adjacent to the sac; (2) the position and extent of the stenosis; and (3) the size and tonus of the sac. They presented illustrations of interesting types of pathology which may be demonstrated radiographically.

## Selection of Patients

Patients for the present study, selected from the Ophthalmic Out-Patient Department, M.Y. Hospital, Indore, were limited to those having chronic dacryocystitis; that is, the cases showed no local signs of acute or subacute inflammation, though there might have been previous acute episodes. To facilitate observation the patients were divided in the following groups:

*Group A.* Epiphora with nonpatent lacrimal system. The simplest manifestation of catarrhal inflammation of the sac is epiphora. This is the only persistent symptom of a nonpatent lacrimal system.

*Group B.* Simple chronic dacryocystitis. The inflamed sac is distended with mucus or pus to form a mucocele or pyocele. There is no history of an acute attack during the course of the disease.

*Group C.* Chronic dacryocystitis with acute exacerbations. This is simple chronic dacryocystitis with a definite history of acute exacerbations.

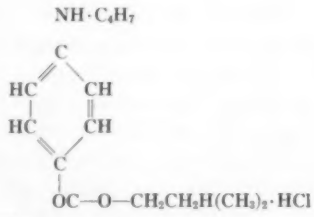
## Selection of Contrast Medium

After testing both viscous and fluid Neo-Hydriol*, the fluid was selected as the dye best suited for injection. Neo-Hydriol fluid is an iodized ethyl ester of fatty acids of poppy-seed oil with high iodine content (40 percent). It is easier to inject than Neo-Hydriol viscous and does not require thinning before injection. It gives no reaction or side-effect.

## Procedure

The equipment required is a 5.0 cc. record syringe, a lacrimal cannula, a canaliculus dilator, Neo-Hydriol fluid, penicillin, solution (2,500 units per cc.), and Anethaine (one-percent drops).

Anesthesia was effected with the Anethaine drops locally in the conjunctival sac, one drop every five minutes three times in all the cases. Anethaine is the hydrochloride of para-butylamino benzoyl dimethyamino ethanol with the formula.




* Manufactured by May & Baker, Ltd., Dagenham, England.

Preliminary syringing is done in cases of chronic dacryocystitis to find out the probable site of obstruction and to facilitate the injection of the dye in the X-ray room. After syringing, the fluid present in the sac was sucked out with an empty syringe. This allowed better filling of the diseased sac with opaque dye and also gave an approximate idea of its capacity.

*Injection technique.* After anesthesia and preliminary syringing with penicillin solution, the patient was taken to the X-ray room, along with the equipment required. The patient was asked to sit on a chair, with his head resting over its back. The lower punctum was dilated. A lacrimal cannula, on a 5.0 cc. record syringe, was inserted into the lower canaliculus as far as the nasal wall of the sac, withdrawn slightly and 0.5 cc. of the dye was injected under gentle even pressure, with care to wipe off any excess dye which regurgitated through the upper punctum. The lid margin and the eyelashes were also painted with the dye for orientation in the X-ray film.

*Roentgenographic technique.* After testing in the chin-nose and forehead-nose position the following routine was followed: (1) forehead-nose, anteroposterior exposure; (2) lateral or oblique exposure.

An upright standing position was chosen because it shortened the procedure and also because it did not interfere with the normal influence of gravity on the drainage of the lacrimal tract. In all dacryocystitis cases, exposures were taken within 10 minutes of the injection.

After exposure, the dye was regurgitated by thumb pressure over the lacrimal area.

## Observations

In all, 30 patients were studied in this series: Group A, six cases; Group B, nine cases; Group C, 15 cases.

### Dacryocystogram

The photographs have been selected from this series, and are typical of the common findings in each group.

Fig. 1 (Agarwal). Posterior-anterior view. A sac of approximately normal size, with obstruction at the sac-duct junction. The filling of canaliculi is suggestive of obstruction.

*Group A.* Epiphora, with nonpatent lacrimal system. Figure 1 reveals an approximately normal sized sac, with obstruction at the sac-duct junction. The filling of canaliculi is suggestive of obstruction. This patient had had epiphora for one and one-half months only and the syringing showed a nonpatent lacrimal system. Figure 2 shows the sac in the right eye to be more shrunken and smaller than that in the left eye. A small shrunken sac is suggestive of long-standing catarrhal infection. This patient had had epiphora in the right eye for three years and in the left eye for one and one-half years.

*Group B.* Simple chronic dacryocystitis. Figures 3A and 3B demonstrate a sac typical of simple chronic dacryocystitis. It is dilated laterally as well as anteroposteriorly. The dilation is greater in the lower part. The site of obstruction is usually at the sac-duct junction. It presents a smooth regular outline.

*Group C.* Chronic dacryocystitis with acute exacerbations is shown in Figures 4A, 5A and 5B. There is dilation of the sac laterally as well as anteroposteriorly. And the dilation is much greater in the upper part, in con-

Fig. 2 (Agarwal). Posterior-anterior view. The patient had epiphora in the right eye for three years and in the left eye for one and one-half years. A small shrunken sac on the right side is suggestive of long-standing catarrhal infection.

trast to Group B. The site of obstruction is usually at the sac-duct junction, but may also be seen in the midduct, as in Figures 5A and 5B which present a comparative study of Groups B and C. In the right eye, the patient had simple chronic dacryocystitis, while in the left eye there was chronic dacryocystitis with acute exacerbations. The

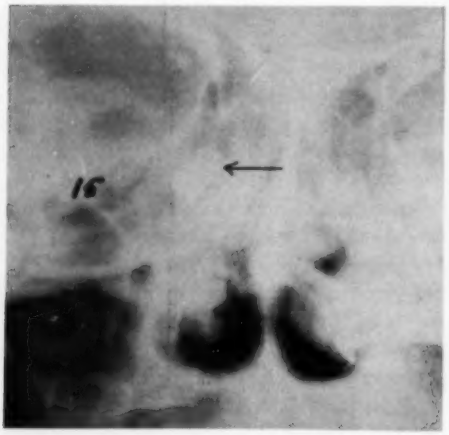


Fig. 3A (Agarwal). Posterior-anterior view. This shows dilation of the sac laterally, with regular outline and obstruction at the sac-duct junction.

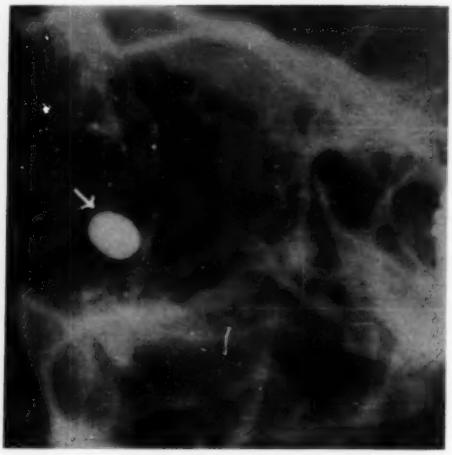


Fig. 3B (Agarwal). Lateral view. The dilation of the sac is more anterior.

sac presents irregularity in its outline and pouches, as can be seen in Figure 6B.

## Discussion

### I. Effect of chronic inflammation on lacrimal sac

1. *Catarrhal inflammation of short duration.* The sac is approximately normal in

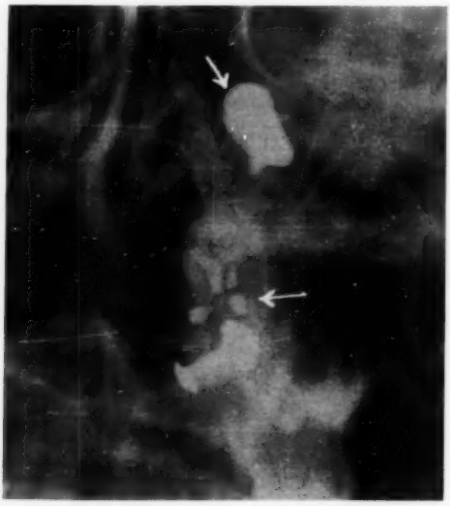


Fig. 4A (Agarwal). Posterior-anterior view. There is more dilation of the sac in its upper part. The dye is present in the nasal fossa, indicating functional block.

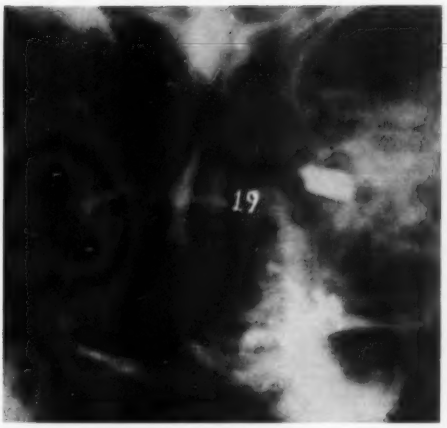


Fig. 4B (Agarwal). Posterior-anterior view. Follow-up film taken after an hour shows decrease in the amount of the dye in the sac (a case of functional block).

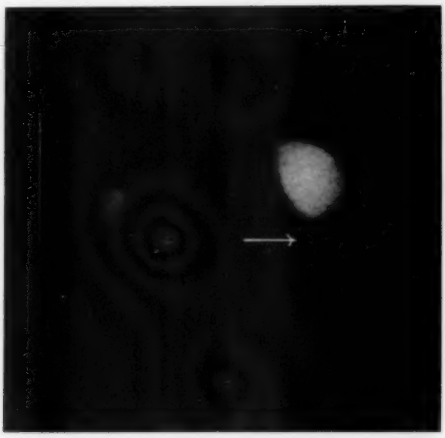


Fig. 5A (Agarwal). Posterior-anterior view. The patient had simple chronic dacryocystitis in the right eye, while the left eye had chronic dacryocystitis with acute exacerbations. The picture presents a beautiful comparative study of Groups B and C.

size with obstruction at the sac-duct junction as seen in Figure 1. Fox[5] presented illustrations of two approximately normal-sized sacs in early cases of obstruction. Blankstein[6] also found a sac of normal size and shape in one of his cases.

2. *Catarrhal inflammation of long duration.* A small, shrunken sac is suggestive of long-standing catarrhal infection (fig. 2).

3. *Chronic inflammation of the sac.* The sac is atonic and dilated to varying degrees, depending on the length and virulence of the infection. Dilation is more anterior (figs. 3A and 3B).

4. *Chronic inflammation with acute exacerbations.* The sac is dilated to varying degrees and more in its upper part (figs. 4A, 5A, 5B, and 6A). There is irregularity of its wall and pouches at places (fig. 6B), indicating adhesions of the sac wall to the surrounding tissues.

## II. Site of obstruction

Since the nasal duct is an osseous canal, it shows no distension. Being narrow, it is usually the site of obstruction. An anatomic fact noted by Wolff[9] furnishes an additional reason for the duct being the common site of obstruction. The sac itself slopes gently outward, while the duct inclines inward. Hence, at the point of junction, there is a slight angulation as well as constriction. It is here that the obstruction usually occurs.

In addition, Schaeffer[10] states that the lumen of the nasolacrimal duct is frequently irregular and tortuous, predisposing to stasis and consequent stricture. In the presence of ascending infection from the nose and con-

Fig. 5B (Agarwal). Oblique view. The left sac is dilated anteriorly and in its upper part, with obstruction in the mid-duct.

Fig. 6A (Agarwal). Posterior-anterior view. The sac is dilated, with slight irregularity in its wall. The obstruction is at the sac-duct junction.

sequent involvement of the nasolacrimal mucosa, the duct soon becomes clogged and stricture will rapidly develop. Even in an early case (fig. 1), the duct has already been closed. Figure 5B shows the site of obstruction in the duct, while Figures 1, 2 and 3A show obstruction at the sac-duct junction.

III. TYPE OF BLOCK (functional or absolute)

Syringing, an important clinical procedure, helps disclose the hidden lesion, giving an approximate idea of the site of obstruction and a rough impression of the size and tone of the sac and the type of block. However, there are some patients who complain of tearing even when irrigation shows patency of the lacrimal passage. In some of these cases, the persistent tearing may be complicated by intermittent bouts of dacryocystitis. After subsidence of the inflammation, syringing again shows patency of the lacrimal system.

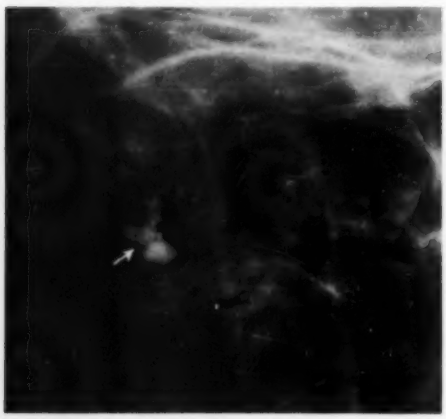


Fig. 6B (Agarwal). Lateral view shows irregularity and pouches, indicating the occurrence of adhesions to surrounding tissue. (The patient had an acute exacerbation.)

This group of patients, if subjected to dacryocystography, reveal an interesting type of pathologic alteration. Figure 4A shows a dilated sac with the dye entering the upper end of the lacrimal duct. The dye is also present in the nasal fossa. The follow-up film (fig. 4B), taken after an hour, shows a decrease in the amount of dye in the sac.

This is a clear case of functional block, a case most suitable for the dacryocystorhinostomy. If such cases are left undiagnosed at an early stage, a frank stenosis ultimately results. As seen in Figure 5A, the sac on the left side is dilated by an obstruction in the duct, suggesting that this absolute block has followed a functional block.

## SUMMARY

Thirty cases were studied by means of Neo-Hydriol fluid as a contrast medium and X-ray examination. Chronic inflammation of the sac as shown by dacryocystography, presents: (1) a small shrunken sac, suggesting long-standing catarrhal inflammation; (2) a dilated atonic sac with smooth outline, suggesting chronic suppurative inflammation; (3) a dilated sac with irregular outline, indicating that there had been acute exacerbation during the course of disease.

The site of obstruction has usually been detected at the sac-duct junction and frequently in the duct. A dacryocystogram reveals whether the type of block is functional or absolute.

*Block No. 18 II C, New Palasia.*

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# BACTERIAL CONJUNCTIVITIS*

## CAUSED BY AN EYE OINTMENT BASE USED AS A PLACEBO IN THERAPEUTIC TRIALS

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The government of the Republic of China, with assistance from the World Health Organization and the United Nations Children Fund, is at present conducting studies to develop methods for the control of trachoma which are effective and practical on a large scale. These studies include the evaluation of the effectiveness of antibiotic eye ointments in curing children suffering from active trachoma.

The therapeutic trials are being conducted among first-grade school children in areas

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of Taiwan with a high prevalence of trachoma. Evaluation is being made of chlorotetracycline and tetracycline in the form of a one-percent ointment and of treatment schedules with ointment application twice a day, both continuously for 48 or 60 days and intermittently five days a month for six months.

In Morocco and other countries of the Mediterranean area the more economic intermittent schedule has proved to be at least as effective as the older continuous schedule.[1] One of the aims of the present study is to confirm that this is also the case in the trachoma of Taiwan.

As part of this study, two groups of children, one by the intermittent and one by the continuous schedule, were to receive a placebo eye ointment base similar to the chlorotetracycline ointment except for the omission of the antibiotic. The field operations called for an earlier start of intermittent treatment so that the therapy would finish at the same time as that of the continuous treatment.

Intermittent therapy was commenced on February 17, 1960. During the first and second months of the five-day treatment, inflammatory eye reactions were reported among children receiving the placebo ointment in five of 20 schools in which placebo ointment was used. Similar inflammatory eye disease was not observed in the groups receiving the two antibiotic ointments or in a control group receiving no ointment.

This is a report of a clinical and laboratory study of a class of first-grade school children receiving placebo eye ointment, and a control group, carried out in an effort to define the cause of the inflammatory eye disease.

## Materials and Methods

Kao-hsu school in a rural area of southern Taiwan was chosen for the study because it had reported inflammatory eye reactions in both the first and second intermittent treatment periods. The details of the methods used in setting up the therapeutic trials will be reported in conjunction with those studies. The groups were randomized with all trachomatous children in a single class receiving the same treatment. One person at each school was trained to administer the ointments to all children in the school who were part of the study. The ointments were applied twice a day, as early and as late in the school session as possible. The placebo ointment tubes were of such size that one entire class received a single treatment from the same tube.

There was one class in the Kao-hsu school (No. 158) in which the 39 trachomatous cases were receiving placebo ointment base under the intermittent treatment schedule. Another class in this same school (No. 161) with 29 trachomatous children was serving as part of the control group receiving no ointment in the therapeutic trials. For this study the trachomatous children in classes 158 and 161 became Groups A and B respectively, and 15 nontrachomatous children of class 158 and 14 of class 161 became Groups C and D.

The third cycle of ointment treatment was begun in Kao-hsu on April 18th. A clinical examination by the same ophthalmologist was performed on April 18th, 21st, 23rd and 29th. Clinical examination was carried out with a monocular loop and focalized light source. The diagnosis of conjunctivitis followed WHO recommendations, and the following symbols will be used in this report: Co.0—no clinical signs of conjunctivitis; Co.1—mild conjunctivitis, hyperemia and no more than a small bead of secretion in the conjunctival sac; Co.2—subacute conjunctivitis, hyperemia and discharge without marked edema of the tissues. No children in this study suffered from acute conjunctivitis (Co.3). Only children who were examined on all four dates are considered as part of the study. This resulted in the loss of two children each from Groups A and B.

Cultures for bacteria in the conjunctiva were carried out on April 18th just prior to the first administration of placebo ointment, on April 21st during treatment and on April

23rd, one day after cessation of treatment.

After a gross examination of the eyes, the ophthalmologist chose the eye with the most abnormality to be cultured. The upper fornix was exposed without contamination, and two platinum bacteriologic loops were rubbed in this area of the conjunctiva.[2] They were immediately streaked, one on a chocolate agar plate and one on a blood agar plate. The clinical examination was completed after the cultures were obtained. The bacteriologic media was incubated at 37°C. and observed at 24-hour intervals. The incubation of both plates was discontinued at 72 hours.

Predominate colonies, plus others that appeared significant, were counted and subcultured for identification.[2] All bacterial colonies from the plates were studied for morphology and staining characteristics.

Alpha hemolytic streptococci were identified and tested for the presence of pneumococci.[3] The staphylococci were identified by morphology and coagulase tests.[3]

Hemophilus aegyptius (Koch-Weeks bacillus) were identified by growth, morphology and straining characteristics.[4,5] They were subcultured from chocolate agar to blood agar plates after spot-inoculating with staphylococcus.[3] The H. aegyptius colonies grew first only in the vicinity of the staphylococcus producing the "satellite phenomenon" shown in Figure 1. In order to differentiate these colonies from H. influenza, it was demonstrated that the short gram-negative rods were noncapsulated and agglutinated human type "O" red blood cells.[6]

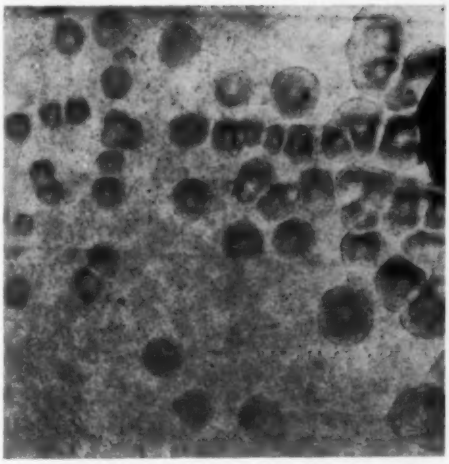

Fig. 1 (Grayston, et al.). This photograph, taken through a dissecting microscope, ×24, is of a section of blood agar medium inoculated with staphylococci and H. aegyptius. The large colonies at the left are staphylococci, and it can be seen that the colonies of H. aegyptius closest to the staphylococci are larger than those more distant (the "satellite phenomenon").

## Results

Conjunctivitis developed in children receiving placebo eye ointment, as it had in the two previous cycles of intermittent therapy. In Group A, a total of 18 children had conjunctivitis diagnosed on at least one of four eye examinations. Only one child each in Groups B. C and D had conjunctivitis. Five of the children in Group A, and the each in Groups B, C and D had conjunctivi- at the first examination, while 13 in Group A, and the one in Group C developed conjunctivitis after the placebo therapy was begun. Over all, conjunctivitis was found in 49 percent of Group A compared to four percent of Group B and seven percent of Groups C and D.

An equally striking difference among the groups was found in the results of the bacterial cultures reported in Table 1. From two of 37 children in Group A with positive cultures on the first examination, the number of positive cultures increased to 25 at the second examination and 22 on the third. Almost all these positive cultures were Hemophilus aegyptius, a primary eye pathogen. This finding contrasts with Groups B, C and D where one third of the children at the maximum had positive cultures and H. aegyptius occurred in only one or two of each group. The positive H. aegyptius cultures in the three control groups were mostly at the second examination on April 21st when this organism was most widespread in Group A, and the placebo ointment was still being administered.

Table 2 shows all children with the diag-

TABLE 1

RESULTS OF BACTERIAL CULTURES OF THE CONJUNCTIVA OF CHILDREN RECEIVING EYE OINTMENT BASE AND CONTROL GROUPS

| Study Group | No. Cultured | Organisms Isolated | Date of Cultures | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | April 18 | | April 21 | | April 23 | |
| | | | No. | % | No. | % | No. | % |
| A | 37 | H. aegyptius | 1 | 3 | 24 | 65 | 19* | 51 |
| | | Streptoccoci | 1 | 3 | 2† | 5 | 3 | 8 |
| | | No growth | 35 | 95 | 12 | 32 | 16 | 43 |
| B | 27 | H. aegyptius | 0 | — | 2 | 7 | 0 | — |
| | | Streptococci | 3 | 11 | 6 | 22 | 2 | 7 |
| | | Staphylococci | 4 | 15 | 1 | 4 | 0 | — |
| | | No growth | 20 | 74 | 18 | 67 | 25 | 93 |
| C | 15 | H. aegyptius | 0 | — | 2 | 13 | 1 | 7 |
| | | Streptococci | 0 | — | 2 | 13 | 0 | — |
| | | Staphylococci | 1 | 7 | 0 | — | 0 | — |
| | | No growth | 14 | 93 | 11 | 73 | 14 | 93 |
| D | 14 | H. aegyptius | 0 | — | 1 | 7 | 0 | — |
| | | Streptococci | 1 | 7 | 1 | 7 | 0 | — |
| | | Staphylococci | 1 | 7 | 1 | 7 | 0 | — |
| | | Diphtheroid | 1 | 7 | 1 | 7 | 0 | — |
| | | No growth | 11 | 79 | 10 | 71 | 14 | 100 |

Notes: Streptococci reported were all alpha hemolytic streptococci with more than 10 colonies per plate.
* Three cases in Group A with H. aegyptius on April 21 were treated with streptomycin eye drops and were negative on April 23.
† One case with alpha hemolytic streptococci also had H. aegyptius isolated.

nosis of conjunctivitis on any of the four examinations, along with results of bacteriologic cultures of their conjunctiva. None of the children with conjunctivitis on April 18th prior to institution of the third course of therapy had bacteria isolated from their eyes at the first examination.

Of the nine children in Group A who had normal eyes on first examination, and had developed conjunctivitis after three days of placebo ointment, eight had H. aegyptius isolated at the second examination. The one exception (A22) who had no growth on all cultures, was diagnosed as a mild conjunctivitis without discharge on the second examination and was again normal on third and fourth clinical examinations. A8 and A25, both of whom developed clinical conjunctivitis between the second and third examination, had numerous H. aegyptius isolated on third examination, and in addition, A8 had a few of these organisms isolated on the second examination. A3, A17 and A20 who were treated with streptomycin eye drops after the second examination were culturally sterile and their conjunctivitis was markedly improved on the third examination. Two children (A14 and A18) who had conjunctivitis on first examination and who had a more severe discharge on the second examination, both had H. aegyptius isolated on the second culture. The other three children with conjunctivitis on the first examination (A7, A26 and A32), showed improvement or little change on subsequent examination. Only in the case of A26 were bacteria isolated. The three cases of conjunctivitis occurring in the control groups were unassociated with bacteria except for D6, where 20 colonies of H. aegyptius were isolated on the second examination only.

Children A3, A17, A18 and A20 were diagnosed as having subacute conjunctivitis at least on one examination. All other cases were considered to be mild conjunctivitis. Except for A3 who demonstrated mucopurulent discharge at the time of the second examination, all the conjunctivitis cases with discharge had either mucoid or mucofibrous discharge.

TABLE 2

CLINICAL DIAGNOSIS AND RESULTS OF CULTURE OF CONJUNCTIVA FOR BACTERIA ON CHILDREN WITH CONJUNCTIVITIS AT ANY OF FOUR EXAMINATIONS

| Case No. | Date of Examination | | | | | | |
|---|---|---|---|---|---|---|---|
| | April 18 | | April 21 | | April 23 | | April 29 |
| | Dx | Bact. | Dx | Bact. | Dx | Bact. | Dx |
| A3 | Co 0 | n g | Co 2MP | H.ae (150) | Co 1(−) | n g* | Co 1(−) |
| A7 | Co 1M | n g | Co 0 | n g | Co 0 | n g | Co 0 |
| A8 | Co 0 | n g | Co 0 | H.ae ( 10) | Co 1M | H.ae (200) | Co 1MF |
| A9 | Co 0 | n g | Co 1M | H.ae (200) | Co 1M | H.ae (200) | Co 1M |
| A10 | Co 0 | n g | Co 1M | H.ae ( 30) | Co 1M | H.ae (100) | Co 0 |
| A11 | Co 0 | n g | Co 1M | H.ae (200) | Co 1M | H.ae ( 10) | Co 1M |
| A13 | Co 0 | n g | Co 1MF | H.ae ( 30) | Co 1M | H.ae (100) | Co 0 |
| A14 | Co 1M | n g | Co 1MF | H.ae ( 60) | Co 1M | H.ae (100) | Co 1M |
| A17 | Co 0 | n g | Co 2M | H.ae (150) | Co 1M | n g* | Co 0 |
| A18 | Co 2M | n g | Co 2MF | H.ae (100) | Co 1M | H.ae ( 20) | Co 1M |
| A20 | Co 0 | n g | Co 2MF | H.ae ( 20) | Co 1M | n g* | Co 0 |
| A22 | Co 0 | n g | Co 1(−) | n g | Co 0 | n g | Co 0 |
| A25 | Co 0 | n g | Co 0 | n g | Co 1M | H.ae (100) | Co 0 |
| A26 | Co 1(−) | n g | Co 0 | H.ae (100) | Co 0 | H.ae (100) | Co 1M |
| A27 | Co 0 | n g | Co 0 | n g | Co 0 | n g | Co 1M |
| A32 | Co 1M | n g | Co 1M | n g | Co 0 | n g | Co 1M |
| A33 | Co 0 | n g | Co 0 | H.ae ( 5) | Co 0 | n g | Co 1M |
| A34 | Co 0 | n g | Co 1M | H.ae (100) | Co 1M | n g | Co 0 |
| B3 | Co 1M | n g | Co 1M | n g | Co 1M | n g | Co 0 |
| C12 | Co 0 | n g | Co 0 | n g | Co 0 | n g | Co 2M |
| D6 | Co 1M | n g | Co 1M | H.ae ( 20) | Co 1M | n g | Co 0 |

Notes: * Three children A3, A17 and A20 received streptomycin eye drops on April 21st and 22. n g = No growth. H.ae = Hemophilus aegyptius. (no.) = number of colonies on plate. Co 0 = No conjunctivitis, Co 1 = Mild conjunctivitis and Co 2 = Subacute conjunctivitis. Discharge = (−) none, M = mucoid, MF = mucofibrous, MP = mucopurulent.

All the cases of conjunctivitis that were associated with the positive bacterial culture had H. aegyptius isolated. The isolations of streptococci, staphylococci and diphtheroids were not connected with clinically diagnosed cases. H. aegyptius was isolated on either the second or third examinations from 12 of the 19 children in Group A who did not suffer from clinical conjunctivitis.

Groups A and B were made up of similar proportions of early cases of trachoma (stages I and II) and cases already showing initial cicitrization (stage III). There was no predilection for conjunctivitis or bacterial infections to develop in either early or cicatrizing cases.

In addition to the cultures obtained from the children's eyes, the single tube of placebo eye ointment used each day was cultured both before and after administration on April 18th and 21st. In addition to the two media used for conjunctival cultures, brain heart infusion broth and thioglycollate liquid media were used. The base eye ointment was sterile on all media on both days.

## DISCUSSION

The eye ointment base was clearly responsible for a number of cases of bacterial conjunctivitis. From the available data the mechanism of action can only be postulated. Spread of pathogenic bacteria from eye to eye by the single tube of ointment used seems unlikely in face of the negative cultures of the ointment before and after use. It would seem more likely that the viscous ointment interfered with the eye's normal defense mechanisms and promoted growth of bacteria which were spread by the normal route of eye to eye by hand or fomite.

Investigation of all schools in which children received placebo ointment was not possible, but in several schools not reporting difficulty with placebo ointment, examination by an ophthalmologist revealed cases of conjunctivitis in the placebo group. The

differences in frequency of conjunctivitis cases in the schools with intermittent schedule placebo ointment groups may well have been on the basis of the presence of eye pathogens in the population. Kao-hsu school was chosen for this study because cases had occurred in the first two cycles of eye ointment therapy. By the time of the third cycle, the pathogen H. aegyptius was probably more widely dispersed among the children. The frequent culture of H. aegyptius was surprising since bacterial conjunctivitis is not a common disease on Taiwan. The absence of seasonal bacterial conjunctivitis is one frequently mentioned factor used to explain the mildness and low incidence of sequela associated with trachoma on Taiwan.

The findings of this study would suggest that the common use of eye ointments without antibiotics is associated with some hazard particularly if eye pathogenic bacteria are present in the environment. Although no difficulties have been encountered in these trials with antibiotic eye ointments, they might be expected to have the same physiologic effect on the eye and to be potentially hazardous if antibiotic resistant bacteria or viruses are present.

Following the results of this study, the plan to use placebo ointment in the continuous schedule of the antibiotic trials was abandoned, and its use in the intermittent schedule discontinued.

## Summary

In a class of first grade school children with active trachoma receiving an eye ointment base as a placebo in a trial of antibiotic eye ointments, 70 percent (26/37) had H. aegyptius isolated from their conjunctiva on at least one or two cultures three and five days after the application of ointment had been begun. This compared with seven percent (2/27) in trachomatous children receiving no ointment and 10 percent (3/29) in nontrachomatous children receiving no ointment who were cultured at the same time. Only one child had H. aegyptius isolated immediately before application of ointment.

These cultures were performed because in two previous five-day cycles of therapy the group receiving placebo ointment had suffered inflammatory eye reactions. At the beginning of this third cycle of therapy, five of 37 children in the placebo ointment group and two of 56 children in the control groups had conjunctivitis. Thirteen additional children in the placebo group developed conjunctivitis after institution of ointment, while only one child developed conjunctivitis in the control groups.

Although 12 children developed H. aegyptius infections without definite clinical findings, all with clinical conjunctivitis lasting at least two days had H. aegyptius isolated from their conjunctiva. All the conjunctivitis cases were classified as mild or subacute, none were severe.

It is concluded that the use of eye ointment base as a placebo is inadvisable, since it appears to promote the growth and spread of pathogenic bacteria which produce clinical conjunctivitis. These results also raise the question of possible deleterious effects of eye ointments in general use.

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# NOTES, CASES, INSTRUMENTS

## SUBHYALOID HEMORRHAGE*

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The cause and source of spontaneous preretinal, or subhyaloid hemorrhage, associated with intracranial subarachnoid hemorrhage have been controversial.

The following case of subhyaloid hemorrhage is reported because of two interesting facts: (1) the absence of intracranial subarachnoid hemorrhage; (2) the virtually instantaneous increase in intracranial pressure and the demonstration of the mechanism of the increase in intracranial pressure.

### CASE REPORT

A 42-year-old man was admitted to the North Carolina Baptist Hospital on April 4, 1959, with urinary retention. He had a history of dysuria and weakness of his legs since childhood. He had noted that, when he received a blow to the low back, he had tingling in his legs and trunk and he had momentary altered consciousness.

Pertinent findings on initial physical examination were deformity of the buttocks, smallness of the left leg with distal weakness and altered sensation over the buttocks, perineum, and legs.

Roentgenographic and myelographic studies showed absence of the left side of the sacrum and a large cystic extension of the caudal sac into the sacral region.

A laminectomy was done on April 10, 1959. The intrasacral myelomeningocele was opened, a tethered spinal cord was freed, and the exposed nerve roots were stimulated (no cystometrographic response was obtained from this stimulation). The dura mater was closed and then supported by a closure of reflected fascia in what was thought to be a watertight manner. The remainder of the wound was closed routinely. His postoperative course was one of rapid convalescence, resumption of satisfactory voiding and urinary control, and increased strength of his legs.

On June 24, 1959, a mild protrusion was noted in the area around the healed wound. Pressure here caused him to have a momentary "blackout" without headache. An electroencephalogram was normal.

He was seen for follow-up neurosurgical evaluation on December 16, 1959. He was doing well but the region of the operative wound had protruded further. Function of the urinary bladder and legs was unchanged subjectively. Over the sacrum there was a 10 by 14 by 6.0 cm., tense protrusion, well covered by skin (fig. 1). Funduscopic examination of the eyes was normal. He was seen in the Urology Section where cystoscopic examination was advised because of an increased pyuria. He was placed in the usual dorsosacral (lithotomy) position; immediately he became unconscious and he had a tonic seizure. This was followed by vomiting, stupor, and confusion, which persisted for about 18 hours, gradually clearing.

After the onset of this violent episode, he was placed in a lateral decubitus position. It was then noted that the protrusion in the sacral region was soft, and 100 cc. of crystal-clear fluid was aspirated from it. Funduscopic examination of the eyes showed numerous, scattered, small, fresh retinal hemorrhages. On the following day (December 17th), careful ophthalmologic examination showed the visual acuity in the right eye to consist of counting fingers at a distance of three feet, and in the left eye of seeing motions of the hand at two feet.

Positive findings were limited to examination of the fundi. The right fundus showed multiple, scattered, retinal hemorrhages. Some of these were typically flame-shaped; others were more superficial, larger, and appeared to have broken into the subhyaloid space. Still others appeared to be deep and the retinal vessels could be seen to cross over them.

Fig. 1 (Weaver and Davis). Protruding sacral meningocele.

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Fig. 2 (Weaver and Davis). Right eye. Hemorrhages deep in the retina with retinal vessels crossing the areas of hemorrhage.

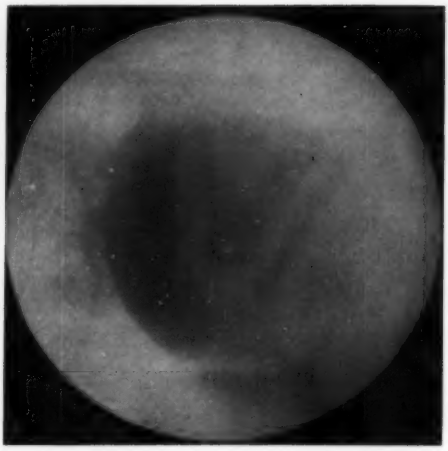

Fig. 3 (Weaver and Davis). Left eye. Typical subhyaloid hemorrhage. Disc is in lefthand corner. Vitreous hazy.

About the right macular area, a group of moderately large hemorrhages were arranged in a star-shaped configuration (fig. 2).

In the left eye there were two large typical subhyaloid hemorrhages, each measuring six disc diameters across, which completely covered all retinal structures (fig. 3). One was temporal and the other nasal to the optic disc and they were nearly confluent above the disc. The vitreous was cloudy because of the presence of a slight amount of blood. On the following day (December 18th) the picture in the right eye was much the same but in the left eye there was no red reflex. Biomicroscopic examination revealed that a large amount of blood had broken into the vitreous and much of it had come as far forward as the anterior one third of the vitreous body.

After the ophthalmologic examination, needle puncture was performed in the lumbar subarachnoid space. Opening pressure of the cerebrospinal fluid was 125 mm. $H_2O$. Crystal-clear fluid was removed with a protein content of 78 mg. per 100 cc. (a normal value for our laboratory). There were six white blood cells and no red blood cells found on microscopic examination. On careful compression of the sacral protrusion, the pressure rose slowly to 200 mm. $H_2O$ and then rapidly to 600 mm. On release of the sacral protrusion, the pressure fell rapidly to a normal level. During the compression, the patient stated that he "almost blacked out."

On December 31, 1959, the intrasacral lesion was re-explored. Two large adjacent cysts, having the appearance of meningocele sacs, were encountered beneath the skin. There was a confluent opening at the level of the laminal arches and a one- to two-mm. opening into the caudal subarachnoid space. This opening was closed, the sac was imbricated thoroughly and the wound was closed in layers. Healing was uncomplicated. There was no recurrence of the mass. His mental status has remained normal, the function of the urinary bladder and legs has been unchanged, and he has returned to work.

The patient received no specific therapy except for a buccal preparation of chymotrypsin three times a day. By March 1, 1960 (11 weeks), all retinal hemorrhages has been resorbed from the right eye and the visual acuity was 20/25. The only residual was slight pigmentary stippling at the macula. Visual acuity of the left eye had improved to 20/70 but no details of the fundus could be seen.

## Comment

There are two principal theories of the cause and source of subhyaloid hemorrhage associated with intracranial subarachnoid hemorrhage. The older of these is that the blood present intracranially in the subarachnoid space seeps along the subarachnoid space of the optic nerve, through the cribriform plate, and into the subhyaloid space. The second, more recent theory, is that a sudden increase in intracranial pressure is transmitted to the orbital veins and this increased pressure causes rupture of retinal veins, which in turn causes the subhyaloid hemorrhage. Both of these theories and the evidence for and against each are thoroughly discussed in recent papers by Walsh and Hedges,[1] Cordes,[2] and Smith, Kearns, and Sayre.[3]

Hedges and Walsh[4] especially pointed out that subhyaloid hemorrhage could occur with significant intracranial hemorrhage.

Both Walsh and Cordes thought that the "extent of the retinal and subhyaloid hemorhage varied with the severity of the vascular accident and the presence or absence of cerebral edema."[2]

The case reported here is interesting because subhyaloid hemorrhage was caused by a sudden rise in intracranial pressure due to compression of a cyst communicating with the intrathecal space. This is similar to the experimental mechanism used by Smith, Kearns, and Sayre to produce a subhyaloid hemorrhage in a monkey. They inserted a needle connected to a reservoir of saline into the cisterna magna of a monkey. By raising the reservoir, they rapidly increased the pressure of the subarachnoid cerebrospinal fluid to 200 mm. Hg and maintained it at that level for one minute. In our case there was neither associated subarachnoid intracranial bleeding nor evidence of cerebral edema.

## Conclusion

This case lends support to the theory that the increase in intracranial pressure is the indirect cause of subhyaloid hemorrhage and that subarachnoid hemorrhage per se does not necessarily cause the subhyaloid hemorrhage.

*Section on Ophthalmology.*

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# FORNIX DEPRESSOR*

## An aid in muscle surgery

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The dissection of the medial conjunctiva when performing a recession operation is, at times, rendered difficult because of the adducted position of the eye. Exorotation may be obtained by grasping the medial conjunctiva with a forceps. This causes uneven stretching of the tissues and the result may be a jagged or inexactly placed incision.

Herein is shown an instrument for presenting the medial canthus in a different way —by depressing the lateral fornix. To effect this, a semicircular ring, 25 mm. in diameter, has been attached to a handle (fig. 1). The ring is introduced into the lower fornix and rotated laterally. By depressing the handle, the assistant can now rotate the eye outward. Since the pressure is evenly distributed over a large area of the fornix, this is a very gentle way of exorotating the eye, though a strong abduction is easy to obtain. With this instrument, the medial canthus will present itself as an evenly stretched plane of conjunctiva. The same tool may be used for endorotation, when performing external muscle surgery.

*van Starkenborghstraat 10*

Fig. 1 (Worst). The fornix depressor.

* From the University Eye Clinic. Head: Prof. Dr. H. M. Dekking. This instrument is manufactured by the Medical Workshop, Kraneweg 94, Groningen, Holland.

## INSTRUMENT FOR INSERTING ENCIRCLING TUBES*

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A simple self-made instrument has been found very helpful in putting encircling polyethylene tubes or silicone rods around the eye in retinal detachment surgery. This instrument consists of a piece of pliable metal wire (silver or copper). A half circle of about 25-mm. diameter is bent on one end of this wire and the tip is flattened out. A hole is drilled through the flattened end. The other end forms a handle at a right angle to the curved end. Two such instruments have been made, one right and one left handed (fig. 1).

Fig. 1 (Wolter). Instrument for inserting encircling tube. (One-third actual size.)

The curved side of the instrument, with the perforated flat end first, can be pushed without effort through Tenon's space and under the eye muscle tendons around the eye starting at the site of the scleral surgery. With a finger of the other hand the tip of the instrument can be felt passing around the eye through the conjunctiva and Tenon's capsule. It is important to feel that the flattened tip always hugs the globe. The diameter of the curve of the instrument can be adjusted at the time of surgery by bending it to fit the size of the individual globe. When the curved wire is pushed in Tenon's space around the eye by a careful turning motion the flat tip will finally appear on the other side of the exposed area of scleral surgery. The tube is then threaded through the hole in the tip and the instrument with the tube attached to it is pulled back.

Using this simple instrument it is possible to insert an encircling tube or rod quickly and without damage to the tissues around more than half of the globe without sectioning conjunctiva and Tenon's capsule all around. A small incision through conjunctiva and Tenon's capsule can be made opposite to the area of scleral surgery to anchor the tube to the sclera.

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## CHALAZION RETRACTOR*

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It is often desirable for the removal of a chalazion through the skin to open up the skin wound fairly widely to be able to isolate the chalazion, or other small tumor, completely to aid in its exposure and dissection. A small lacrimal three-pronged speculum has been modified by the removal of the end prong to make an ideal speculum for this purpose. After the chalazion clamp is applied, the skin incision made and the cyst exposed, this speculum can be inserted between the lips of the wound and spread to give excellent exposure and allow better inspection of this area, thereby enabling one to remove the chalazion completely.

Fig. 1 (Hughes). A chalazion retractor.

*131 Fulton Avenue.*

* Made by Storz Instrument Company, Saint Louis, Missouri.

# COMPLICATIONS IN EYE SURGERY*

## Due to introduction into the anterior chamber of solutions erroneously prepared with an antiseptic

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Since October, 1958, the method of J. Barraquer[1] of cataract extraction with the use of alpha chymotrypsin has been used in about 650 cataract extractions. According to Barraquer's recommendation, acetylcholine in a 1:1000 solution has been injected into the anterior chamber after delivery of the lens to achieve quick and maximal miosis in cases in which this seemed desirable. In all cases, both in those in which no acetylcholine was used and in those in which it was injected, pilocarpine (6.0 percent) and eserine (1.0 percent) were automatically instilled into the conjunctival sac immediately after the delivery of the lens, as was the custom in the prechymotrypsin era.

In a number of cases handled in this way, an unusually intensive striate keratitis with pronounced corneal edema was observed at the first dressing on the second day. The question arose whether this complication was due to the chymotrypsin, or to irrigation of the anterior chamber with saline to remove the chymotrypsin after it had accomplished its purpose, or to the acetylcholine, which was injected after the extraction.

Although, in nearly all these cases, the corneal opacities cleared within four to six weeks and only in two cases a fine permanent opacity of the deep corneal layers in the upper corneal third remained, not disturbing the final visual success, the cause of the corneal complications remained an enigma to us and a great worry.

A personal communication from Dr. Hauer, who had had a similar experience, claimed that the chemical analysis of the acetylcholine, which he had used in a cataract case with a consequent severe corneal opacity, disclosed a decomposition of acetylcholine to pure acetic acid, induced us to stop the use of acetylcholine and instead to inject two to five minims of an 0.5-percent solution of pilocarpine into the chamber.

During the following two months about 80 cataracts were extracted and among these 10 cases occurred in which the cornea was postoperatively severely involved by an excessive striate keratitis and an intensive edema, the iris being hyperemic and discolored and the vitreous membrane thickened. The pupil could not be dilated because of the development of posterior synechias. These complications did not occur in a continuous series but on different operative days. Only two cases showing these complications happened to be operated on the same day.

In three cases the corneal edema cleared slowly in the course of three to four weeks under treatment with corticosteroids and disappeared completely at the end of about five to six weeks. In the seven remaining cases, however, a permanent corneal dystrophy developed and could not be improved. These eyes later developed a secondary glaucoma and though they preserved vision of finger counting, they were practically lost.

Although in all these 10 cases, pilocarpine had been injected into the chamber after the extraction, the pilocarpine did not seem to be the guilty factor because it was also used in many other cases in which these complications did not occur. We were even on the verge of giving up chymotrypsin as the possible noxious agent in spite of its great advantages. Then a case came up which clarified the situation.

An eight-mm. perforating graft was done in a case of keratoconus. After the graft had been sutured to its bed, the same solution of 0.5-percent pilocarpine was injected into the anterior chamber to get a good miosis and remove the sphincter from the neighborhood of the corneal section. At the first

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dressing after four days, a severe mixed injection, diffuse corneal edema with many folds in Descemet's membrane of the host cornea as well as of the graft, discoloration and hyperemia of the iris and exudation on the lens capsule, which was opaque, showed that something unusual must have happened.

In the search for the cause of the complication in this case in which no chymotrypsin was used, it was discovered that the solution of pilocarpine used for intracameral injections was prepared in the pharmacy in the same way as the other eyedrops, namely with mercury oxycyanate (1:5,000). There could be little doubt that this antiseptic was the noxious agent which produced the tissue damage. This mistake was immediately corrected and the pilocarpine solution prepared in saline. Since then, no similar accident occurred in more than 200 cataract extractions using alpha chymotrysin and injecting pilocarpine into the chamber when necessary.

In order to prove the assumed noxious action of mercury oxycyanate on the cornea and iris, two minims of a solution of 1:5,000 were injected into the anterior chamber of a rabbit eye after evacuation of the aqueous. A diffuse corneal opacity with intensive corneal edema developed within 24 hours and cleared only slowly during a fortnight. A slight diffuse corneal opacity in the deep layers of the cornea remained as a permanent damage.

The toxic action of mercury salts on tissue, due to the metallic affinity for sulfhydryl groups and their power of precipitating proteins, has been known for long.

Wagenmann[2] and others proved that a solution of mercury perchloride (corrosive sublimate) 1:10,000 when injected into the anterior chamber, a form of treatment which was at one time advised for intraocular infections, causes necrosis of the endothelium followed by a parenchymatous opacity.

Leber[3] demonstrated the violence of the reaction following the introduction of various very dilute mercuric salts into the substance of the cornea, the anterior chamber and the vitreous.

In retrospect we wondered why similar accidents did not occur in the time before the use of chymotrypin when occasionally pilocarpine had been injected into the anterior chamber after a cataract extraction. At that time no 0.5-percent solution of pilocarpine had been present on the tray and the nurse prepared the weak solution by dilution of two-percent pilocarpine eyedrops, using saline for dilution. Though this pilocarpine solution also contained mercury oxycyanate, this was diluted by the saline to a concentration of 1:20,000 and, in this concentration, it seems to have been harmless. We were also astonished as to why the tissue damage did not appear in all cases in which the 0.5-percent pilocarpine in the solution of mercury oxycyanate of 1:5,000 was used. This can be explained only by the assumption that in these cases the major part of the injected amount had escaped out of the chamber when the iris was replaced or air was injected into the chamber or that the quantity of fluid which was injected was very small and diluted by the still-present rests of fluid.

In retrospect it was also remembered that a similar complication with damage to the iris and the lens capsule was observed two years earlier after an uncomplicated perforating keratoplasty. In this case atropine in the same mercury oxycyanate solution was repeatedly dropped on the open eye before the graft was put into its bed.

After this, the antiseptic was eliminated from all eyedrops used for instillation in the operating theater because the possibility could not be excluded that these solutions, when instilled into the conjunctival sac after the delivery of the lens or on an open eye during perforating corneal grafting, might enter the anterior chamber. Negative pressure within the eyeball, occurring when the eye is very soft and collapsed, may cause aspiration of fluid. It occasionally does aspirate an air bubble. Such an event might have been the cause of some more pronounced cases of postoperative keratitis and

iritis not otherwise explained by the operation.

Stallard[4] reports that Zephiran may cause a violent tissue reaction when it enters the anterior chamber and McDonald[5] cites a personal communication of Foster that an accidental irrigation of the anterior chamber with a solution of Zephiran caused a severe and uncontrollable keratitis. He, therefore, claims rightly that it is a good practice not to have any solutions on the tray except normal saline.

After our unfortunate experience, this claim should be expanded to the advice to use only eye drops and eye solutions in the operating theater which are prepared in distilled water or a physiologic medium and to sterilize them by autoclaving, using for each case individual bottles to minimize contamination.

SUMMARY

Severe corneal damage was caused in 10 cases of cataract extraction and in two cases of a perforating graft by the introduction into the anterior chamber of solutions which had been erroneously prepared with mercury oxycyanate (1:5,000) as an antiseptic.

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## CONVENIENT METHOD FOR USE OF CHYMOTRYPSIN IN CATARACT SURGERY*

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Since chymotrypsin was introduced for zonulolysis in cataract surgery by Barraquer,† it has become recognized as a useful tool for zonulolysis, especially for cataract surgery in young patients. However, the original procedure for use of this enzyme adds additional steps to the method of cataract extraction: the introduction of the enzyme solution into the posterior chamber by irrigation syringe or some other instrument, time required for the enzyme solution to disintegrate the zonule without its effect going so far as to damage the vitreous surface, and thorough washing of anterior chamber so that no trace of enzyme will remain in the eye. In addition, it has been our experience that this procedure leads to occasional accidents, such as vitreous loss or premature dislocation of the lens, which are presumably caused by the enzyme itself as well as by individual variation in the structure of the zonule.

Several months ago we adopted for the use of this enzyme a new method which we find simple, safe and convenient. As we could not find any description of the same method in the literature, we thought it worth while to record it here, although some other ophthalmologists may already be using the same procedure.‡

Our new method is the same method as in cataract extraction using the erisophake, the only difference being to fill the internal cavity of the erisophake with chymotrypsin solution (0.01 percent) just before its use, and thorough irrigation of anterior cham-

* From the Department of Ophthalmology, Juntendo University.

† Barraquer, J.: Anales del Instituto Barraquer (Bacelona), 1: No. 1, 1959.

‡ He is right. Other ophthalmologists are using this method with enthusiasm (Editor).

ber after lens extraction. By this method, the enzyme solution spreads evenly and gently all around the lens, the zonulolysis takes place evenly around the lens and there is much less danger of damage to the vitreous surface. Moreover, the extent of zonulolysis can be felt through the erisophake and the tumbling of the lens can be done at the most suitable moment. Break of the lens capsule may occur if the lens is tumbled too early; there should be no haste at this step for which at least a minute or two is necessary, especially in young patients. The inside of the erisophake should be thoroughly cleaned before use by flushing with sterile normal saline for at least three times. The normal saline which fills the erisophake is replaced by enzyme solution just before its application on the lens surface.

Since we adopted this procedure, we have experienced no accident presumably caused by the enzyme, even when the cataract surgery was performed by beginners and the operations have been done uneventfully in patients as young as 10 years of age. The vitreous surface is in satisfactory state when examined by slitlamp a few weeks after operation.

Systemic administration of corticosteroids from just after operation until a few days after operation is found to be useful in suppressing the undesirable reactions caused by the operation.

*Department of Ophthalmology.*

## IRIS CORNEAL CONTACT LENS*

Louis J. Girard, M.D., Richard N. Camp, Vernon R. Lamb, Charles B. Richardson and Joseph W. Soper
*Houston, Texas*

The need for a method that would give better visual acuity than spectacles in certain pathologic conditions brought about the development of contact lenses. Subsequently, contact lenses have been found to be successful in cases of keratoconus; high degrees of hyperopia, myopia and astigmatism; corneal opacities and monocular aphakia.[1,3] The acceptibility of contact lenses as a therapeutic aid in these conditions was the basis of the early research that made possible the contact lens of today.[4,5] Formerly, the large majority of contact lenses were worn for therapeutic reasons; today the majority are worn for cosmetic relief from spectacles.

The purpose of this report is to describe a corneal contact lens with the incorporation of an iris and pupil. Such a lens has been successful for several patients who had obtained only partial therapeutic or cosmetic results with other types of contact lenses. To our knowledge the only previous work on a similar type lens is in the form of a corneal lens with a clear pupillary area and a solidly colored periphery.[6]

The use of the iris corneal lens is illustrated (figs. 1 and 2) in a case of wide iridectomy following monocular cataract surgery, showing a pronounced cosmetic improvement. In this instance the lens decreased photophobia and stray light disper-

Fig. 1 (Girard, et al.) Wide iridectomy following monocular traumatic cataract surgey.

Fig. 2. (Girard, et al.). Same patient as in Figure 1, with iris corneal contact lens in place, showing cosmetic effect.

* From the Division of Ophthalmology, Baylor University College of Medicine. Supported by a grant from Knights Templar Eye Foundation.

Fig. 3 (Girard, et al.). Patient with aniridia and nystagmus.

Fig. 4 (Girard, et al.). Figure 3, with iris lens in place.

sion. Visual acuity was increased to 20/15 from 20/20 − 2 with the ordinary contact lens. Figures 3 and 4 show the iris lens used in a case of aniridia and nystagmus. Visual acuity was unchanged but the nystagmus was greatly reduced. Additional indications for the iris lens are albinism or unsightly corneal scarring.

There are certain problems to be noted in connection with this type of lens. The visual field is narrowed slightly when a four-mm. pupillary opening is used. Fitting depends on exact duplication of a previously fitted noniris corneal lens, as the painted iris obstructs direct observation of the lens-cornea relationship.

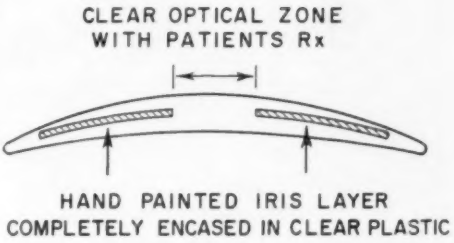


Fig. 5 (Girard, et al.). Cross section of iris corneal contact lens.

Figure 5 shows a cross section of an iris corneal lens. The manufacturing tolerances are much finer than in normal contact lenses. In cutting and polishing either the anterior or posterior curvatures, these surfaces may be within 0.01 mm. of the painted layer. The very slightest miscalculation will cause a completely misfitted lens. The painted layer is individually done artistically to duplicate the normal eye, as in the case shown in Figures 1 and 2.

In summary, the iris corneal contact lens potentially can provide increased visual acuity by the creation of a pupil with the lens substance. It has been found to reduce photophobia and light dispersion, and the cosmetic effect is enhanced. The technical problems of manufacturing, iris duplication, and fitting demand techniques and skills beyond those generally used in manufacturing and fitting noniris lenses.

*Division of Ophthalmology.*

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# PEDUNCULATED HEMANGIOMAS OF CONJUNCTIVA*

## A REPORT OF TWO CASES

M. S. NIRANKARI, F.R.C.S.
AND
DALJIT SINGH, D.O.M.S.
*Amritsar, India*

Apart from injury, bleeding from the conjunctiva is relatively rare. One of the important causes of bleeding from the conjunctiva is an angioma. Thin-walled blood vessels covered only with epithelium can easily be damaged and bleed. Untreated angiomas can increase in size and subsequent constriction at the site of origin can give them a pedicle.

Reported are two cases of pedunculated hemangiomas, one arising from the upper fornix and the other from the lower.

### CASE REPORTS

CASE 1

S. D., a 20-year-old man came to us on February 18, 1957, with the complaints of bleeding from the right eye for two months, a bleeding mass in the same eye for 21 days and general bodily weakness for 15 days.

Two months ago the patient noticed a small amount of reddish discharge on arising which he dismissed as of no consequence. After a few days he again noticed the discharge and recognized it as blood. A village Hakim (a person practising native medicine) gave him some eyedrops. However, the quantity of blood in the tears kept increasing. In about 10 days, drops of blood started trickling down his face. The amount of daily discharge of blood increased to about two ounces. The patient left his usual farming work and took to bed.

Twenty-one days ago he noticed a small mass protruding from under the upper lid. The size of the mass and the loss of blood increased progressively.

On examination, the first thing that struck the observer was a mass coming out from under the upper lid of the right eye, bleeding profusely. The mass, the size of a small cherry, was friable and soft. It moved freely and a pedicle could be traced to the upper fornix at about the middle of the lid (fig. 1). Blood hemoglobin at the time of admission was 6.5 gm.

*Treatment.* At operation, the friable mass broke away from the pedicle on everting the lid (fig. 2).

Fig. 1 (Nirankari and Daljit). Pedunculated hemangioma arising from upper lid (Case 1).

The pedicle was scraped and the oozing surface was cauterized with a hot probe. The bleeding was stopped instantaneously. Recurrence had not been reported so far.

*The histopathologic report* shows a large partially necrotic hemangioma. The nuclei of the endothelial cells are large and vesicular and exhibit an occasional mitotic figure. Vessel formation is well marked throughout the specimen but some small solid knots of endothelial cells are seen. This is an exuberent, but essentially benign, hemangioma which may recur. The remote possibility of hemangio-endothelioma cannot be wholly excluded (figs. 3A and 3B). (This report was kindly given by Dr. Greer of Melbourne.)

CASE 2

T. S., a 16-year-old youth, came on January 13, 1959, with the complaints of a growth under the

Fig. 2 (Nirankari and Daljit). Pedicle of polypus arising from the upper fornix. The lid has been everted. (Case 1).

* From the Department of Ophthalmology and Otolaryngoiogy, Medical College.

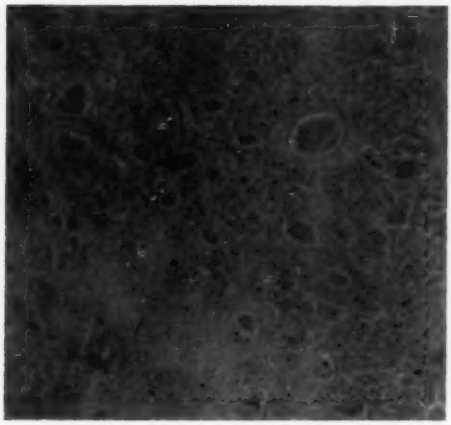

Fig. 3A (Nirankari and Daljit). Low-power view of histopathologic specimen in Case 1.

Fig. 4 (Nirankari and Daljit). Pedunculated hemangioma arising from right lower fornix. The hemorrhagic area of the tumor is dark in color. (Case 2).

right lower lid for one and one-half years and occasional slight bleeding for seven months.

The patient noticed a small beadlike swelling under the right lower lid one and one-half years ago. It gradually increased in size till about seven months ago when it grew out from under the lid in front of the cornea. The patient could, with the help of a finger, push the mass under the lower lid where it would stay with some effort of the lid muscle. Manipulating the tumor under the lower lid in this way would produce abrasion and a small amount of bleeding would occur.

Six months ago the patient suffered from a corneal ulcer caused by constant rubbing of the growth on the cornea or by manipulating the tumor under the lower lid. An opacity of the cornea resulted. The slow progressive increase in size of the growth embarrassed vision, that is why the patient came for consultation.

The tumor, about one cm. in diameter, arose by a pedicle from the lower fornix at the middle of the lower lid. Pinkish in color and soft in consistency, it had a small ulcerated area at the top from which blood was oozing (dark portion of the mass in fig. 4). The surface of the tumor toward the sclerocornea was concave, having been molded by this structure.

*Treatment.* The tumor was removed from its base by a snip with scissors and the site of origin was sutured. The pathologist (Dr. N. L. Chitkara of Amritsar) reported a case of hemangioma (figs. 5A and 5B).

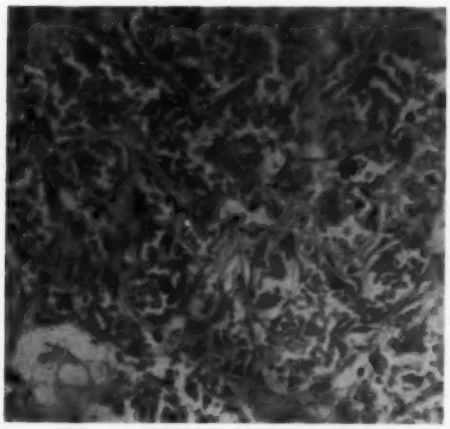

Fig. 3B (Nirankari and Daljit). High-power view of histopathologic specimen in Case 1.

## Discussion

It is not infrequent to come across a case showing serosanguinous discharge caused by a severe inflammation of conjunctiva but few surgeons have seen a case showing tears of blood. Apart from injury frank bleeding from the conjunctival sac is rare. The various causes are hemophilia, vicarious menstruation and vascular tumor.

Hemophilia which is considered the most common cause of bleeding from the conjuctiva has never been seen by us in this part of the country. One of us (Nirankari) once saw a newborn baby with tears of blood. On evertion of the upper lid a telangiectatic spot was seen on the upper palpebral conjunctiva. It was touched with a heated probe

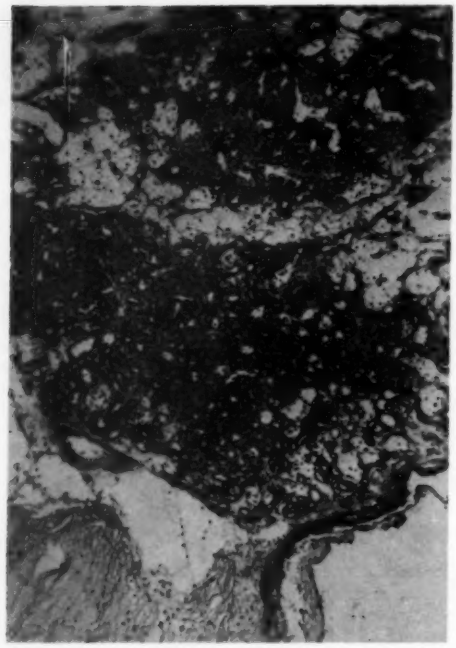

Fig. 5A (Nirankari and Daljit). Low-power view.

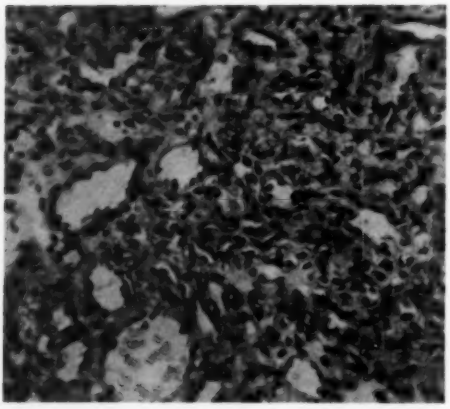

Fig. 5B (Nirankari and Daljit). High-power view.

and the bleeding stopped. The cause was obvious.

The vascular tumors causing blood-stained or frankly bloody tears have rarely been described in the ophthalmic literature. Reports on pedunculated hemangiomas are also rare. Both James and Trevor and Bakkar referred to cases of pedunculated tumors of conjunctiva and remarked about their extreme rarity.

Conjunctival tumors arising from the fornices frequently become pedunculated by growing in the direction of least resistance. When the growth arises from the upper fornix, the lid movements and the effect of gravity aid formation of a pedicle. Probably gravity alone operates for the tumors arising from the lower fornix, the lid movements here being minimal.

Both the hemangiomas described herein arose from the fornices, one from the upper and the other from the lower. Bleeding was the dominant symptom in both the cases, although the second case presented when the growth had started interfering with vision.

Jessop (1895) described a patient who was brought to his clinic in a state of collapse from hemorrhage from an ulcerated nevus. The condition in our first case could be compared to that described by Jessop. The weakness was marked but there was no collapse. The general condition may well have deteriorated further had the patient waited a few days more before seeking treatment.

The treatment of the bleeding vascular tumors of the conjunctiva, terrifying to the patient, is simple and his gratification extreme. One has only to turn the lid to decide what to do. The result is miraculous.

*Department of Ophthalmology.*

We are grateful to Dr. Greer of Melbourne and Dr. N. L. Chitkara who did the pathologic examinations for us.

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# SOCIETY PROCEEDINGS

Edited by Donald M. Lyle, M.D.

## HUNGARIAN OPHTHALMOLOGICAL SOCIETY

April 1, 1960

Aladár Kettesy, M.D., *President*

### Electric erisophake

Dr. Gy. Lugossy demonstrated an apparatus called electric erisophake, which if attached to an electric pump provides for suction in the range of 0 to 600 mm. Hg. By the use of the erisophake intracapsular operations can be performed in almost every case except intumescent cataract, which may be removed by expression without damaging the capsule.

### Terramycin ointment

Dr. Á. Kahán and Dr. I. Pápay delivered a lecture "On some problems of the efficacy of the terramycin ophthalmic ointment" and pointed out that terramycin containing borate would be dissolved 12 times better than the borate-free terramycin base. However, the ointment containing terramycin borate was more irritating to the conjunctiva than that containing terramycin base. The commonly used terramycin ointment containing hydrochloric acid was inferior to terramycin borate in that it was a much stronger irritant, causing complaints more often. The pharmaceutical industry should produce ointments containing terramycin borate so that there would be no need to wait until terramycin borate was formed from sodium borate and oxytetracyclin-HCl in the conjunctival sac. The ointment itself should be so prepared that it would contain terramycin borate.

*Discussion.* Dr. I. Grósz asked whether lipid solubility tests had been done. Did this ointment turn brown, as is common with terramycin ointments? Were there sterility tests?

Dr. S. Káli Nagy asked whether terramycin ointment alone could cure trachoma.

Dr. I. Czukrász said that, if continued long enough, terramycin ointment treatment of the conjunctiva would cause first a deformation then a disappearance of inclusion bodies from the conjunctival epithelial cells. Papillary overgrowths needed, of course, removal by mechanical interventions.

Dr. Kahán replied that the lipid solubility of antibiotics was important in the treatment of intraocular conditions, while in the treatment of the conjunctiva water solubility seemed to be of decisive importance. Terramycin was known to be yellow as long as it had an acid reaction and to turn brown when the reaction turns alkaline. There was no use starting out with oxytetracyclin-HCl, it would turn brown when the pH increased to 7.5, without, however, interfering with antibiotic activity. The sterility tests were done. If used long enough, terramycin ointment alone was capable of curing trachoma. The higher the concentration of terramycin on the conjunctiva, the sooner the inclusion bodies would disappear. This was another reason favoring use of terramycin borate ointment, since it provides a fourfold concentration in the conjunctiva, as compared with oxytetracyclin-HCl.

### Sclerokeratitis and erythema nodosum

Dr. O. P. Szántó reported a case observed for a longer period in which the superficial areas were jellylike, while the deeper ones remained intact. Tuberculosis seemed to be the most likely etiologic factor.

### Endogenous uveitis

Dr. Z. Laffers reported on the *endogenous uveitis symposium* (Munich, 1959) which lasted three days and at which the more than 30 lectures led to productive debates concerning controversial problems of uveitis. The clinical and serologic problems

involved in focal infection, tuberculosis, toxoplasmosis, leptospirosis, brucellosis, and so forth gave rise to particularly lively discussions. Tests on the aqueous humor left no doubt as to the significance of local antibody formation in uveitis. Technical advance is needed in biochemistry so as to improve the reliability of immunologic observations.

Gyula Lugossy,
*Reporter.*

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## YALE UNIVERSITY POSTGRADUATE SERIES

March 11, 1960

R. M. Fasanella, M.D., *presiding*

### Secondary glaucomas

H. Saul Sugar, M.D.: With the introduction into ophthalmology of the carbonic anhydrase inhibitors and the corticosteroids, the treatment of many of the secondary glaucomas has been changed to a considerable extent. These drugs have improved the prognosis of both the medical and the surgical results.

Dr. Sugar then classified secondary glaucoma, stressing the pupillary-block glaucoma in aphakic eyes. Two means are suggested for determining which of these is functionally and anatomically in the proper group: tonography and gonioscopy. These techniques are also suggested for study of the other types of simple glaucoma to corroborate or disprove our ideas regarding etiology and etiologic classification.

One may summarize pupil block in aphakia as due to a combination of blocking of the pupil opening as well as to absence, closure or seclusion of all iridectomy or iridotomy openings between the anterior and posterior chambers. The pupil block is due to close contact or adhesion between the hyaloid membrane and the pupil border or the presence of an inflammatory membrane secluding the pupil. In some cases there is, presumably, complete posterior adhesion of the iris to the intact hyaloid membrane, even though the pupil border itself may be completely or partly free. A recent case suggests that peripheral iridectomies may be present and open but adherent at their borders to the intact hyaloid.

### Pupil block in aphakic eyes

Dr. Sugar said that this classification included:

1. Aphakic eyes with or without iridectomy in which the pupil is blocked by a membrane, usually inflammatory, or by lens material after extracapsular extraction.

2. Cases in which, after intracapsular cataract extraction, the pupil and iridectomy openings are blocked by adhesion of iris to the intact hyaloid membrane.

3. Cases in which, after discission of cataract, usually where no iridectomy is present, the pupillary opening is blocked by the hyaloid, posterior capsule, lens material, an inflammatory membrane, or "solid" vitreous.

4. Cases with air blockade after cataract extraction or cyclodialysis.

Late shallowness of the anterior chamber without evidence of wound leak or choroidal separation should lead one to suspect the presence of pupil block, even before any elevation of intraocular pressure. It should be particularly suspected with any elevation of tension. Chandler used a lower tension value of 22 mm. Hg in designating pupil block but it is more likely that pupil block can occur even in the presence of hypotony, if there is marked suppression of aqueous formation.

One may find an uneven depth of the anterior chamber in some cases where an inflammatory membrane stretches across part of the chamber and prevents the entire chamber from becoming shallow. Such an occurrence should arouse suspicion of pupil block.

The possibility of wound leak associated with loss of anterior chamber volume and choroidal separation must be considered in late emptying of the anterior chamber and was considered in my own cases but was

not found. In each case three to five corneoscleral sutures with a limbus-based flap were used. The sutures included one preplaced McLean suture and two to four postplaced sutures of the same type. The anterior chamber was reformed at the first dressing in each case and remained so during the early postoperative period, although in one case it was relatively shallow.

The treatment of pupil block may be summarized as follows:

If no increase in intraocular pressure is present (that is, the angle is still unblocked) iridotomy or, preferably, iridectomy is all that is necessary to by-pass the interference with communication between the anterior and posterior chambers unless, of course, one can break the pupil block medically.

In a cataract case where, after attempting an intracapsular extraction the posterior capsule and cortex remain, the pupil and peripheral iridectomies may be blocked when the cortical material swells. In such a case the patient may be taken to the operating room, the central corneoscleral suture opened and the conjunctival flap retracted. The iridectomy is then completed. Irrigation of the anterior chamber may be done. To prevent such an occurrence, when the capsule ruptures and the posterior capsule and cortex remain, one should do, and I wish I always had done, a complete iridectomy above even after two peripheral iridectomies have been done previously.

If the intraocular pressure is elevated, both the pupil block and angle block must be relieved. If this occurs after healing of a cataract operation a combination of cyclodialysis and iridotomy or iridectomy is essential. Either cyclodialysis alone or iridectomy alone fails to relieve the condition. However, the combination of cyclodialysis and iridotomy or iridectomy relieves both pupil block and angle block.

My experience with pupil block has taught me not to do iridotomies when iridectomies can be done, since the iridotomies can more easily close, and to prefer multiple rather than single iridectomy in round-pupil cataract surgery. Iridectomies should not be made in the far periphery or, if they are, they should be reasonably large. Perhaps it would be wisest to prevent all this and, in addition, to prevent ophthalmoscopic difficulty in those patients who later develop retinal detachment by doing complete iridectomies in each cataract case, as advised by Schepens.

In the case of a needling operation for congenital cataract I have seen the swelling lens material or even the dislocated nucleus bulge out and block the pupil, causing a secondary glaucoma. I have learned, therefore, always to do an iridotomy just before withdrawing the needle-knife from the eye after performing a discission.

In summary, the medical treatment of the secondary glaucomas depends on the various causes. In most cases, especially where prolonged use is not necessary, Diamox is extremely valuable. Two-percent epinephrine may also be very helpful. Where inflammation is present the cortisones and ACTH are particularly useful. Whether miotics or mydriatics are used depends on the factors in each disease and sometimes on the individual case itself. However, the triad of (1) Diamox and epinephrine, (2) ACTH or cortisones, and (3) miotics or cycloplegics make the medical therapy of these conditions a much more effective method of treatment than was possible in the past.

*Discussion.* DR. SCHARD asked what Dr. Sugar thought about the use of iridencleisis in an aphakic eye.

DR. SUGAR replied that he tries to avoid an iridencleisis in glaucoma following a cataract extraction because of the danger of vitreous loss.

DR. DONALD KAPLAN asked if in aphakia following a pupillary block with angle closure Dr. Sugar did iridectomy and cyclodialysis through the same incision.

DR. SUGAR replied that he did not, as a rule, do this, preferring two incisions, making the cyclodialysis incision further back.

However, by making the scleral incision close to the limbus, the iridectomy can be made through the same incision following the cyclodialysis.

DR. GLASS asked if Dr. Sugar ever saw a case of pupillary block in which a complete iridectomy had been performed.

DR. SUGAR replied that he had not. He added that in cataract surgery vanity is a factor in determining whether to do a round-pupil extraction or an iridectomy. He added that if iridectomies are to be done he would prefer at least two and that he preferred iridectomies to iridotomies. He also preferred not making iridotomies in the periphery. He pointed out that in terms of proper management of postcataract detachments, an iridectomy, of course, was most helpful.

DR. ZUCKERMAN said he saw a case with pupillary block following a complete iridectomy and lens extraction. Ten-percent Neosynephrine broke the block in about 15 minutes.

DR. SUGAR replied that, in this case, there were posterior synechias to the hyaloid just as in the case he presented which had pupil block and two peripheral iridectomies that showed adhesions between their borders and the hyaloid.

DR. LOVEKIN asked whether Dr. Sugar felt that an intumescent lens with 20/20 vision should be removed as a causative factor in glaucoma.

DR. SUGAR replied that unless there were cataractous changes he would not want to remove the lens and that he would look for another cause for the glaucoma.

DR. ZUCKERMAN asked why, in pupillary block, Dr. Sugar prepared to do an iridectomy over a transfixion of the iris.

DR. SUGAR replied that in pupillary block in the phakic he thought principally of the safety factor. In aphakics he felt that it was safer to get a complete lasting opening. More important is the fact that in most of these cases angle block has already occurred and transfixion does not help while iridectomy may be broad and help open the angle if basal.

DR. GLASS asked if, in cases with pupillary block and low tensions, choroidal detachment or wound leakage was noted.

DR. SUGAR replied that often there was no evidence of a leaking wound or a choroidal detachment. He added that even testing with fluorescein might not show leakage because some of these cases had an arrest of aqueous secretion.

DR. MOTT asked if the glaucoma associated with Sturge-Weber disease was due to an angioma in the angle.

DR. SUGAR replied that as a rule the angioma was in the choroid. He added that maybe in some of these cases there was hypersecretion of aqueous due to increased blood supply to the ciliary body.

DR. WONG asked about Dr. Sugar's choice of treatment in epithelial downgrowth.

DR. SUGAR replied treatment is usually not good. I have not personally used curettage and alcohol as suggested by Maumenee but this would be my first choice. X-ray therapy may be helpful.

Dr. Phillips asked about the follow-up treatment of uveitis in which the tension remained in the range of 40 mm. Hg but the uveitis was completely burned out.

DR. SUGAR replied that he would treat this as a case of chronic simple glaucoma.

DR. ZUCKERMAN asked about side-effects of Diamox.

DR. SUGAR replied that Dr. Thomas Maren who did much of the original work pointed out that one does not have to fear the metabolic acidosis associated with Diamox if it is used continuously and not intermittently. Kidney stones are due to a decrease in citrate excretion which interferes with the calcium complex. Urologists should be warned not to increase the acidity in the urine to dissolve these stones. This would only cause more stones. With the use of Diamox there is a decrease of hydrochloric acid in the stomach. This may account for the lack of appetite. Therefore, Diamox

might be indicated in glaucoma patients, especially those who also have stomach ulcer. Diamox should not be used in patients with cirrhosis of the liver. Neptazane might be a more effective drug than Diamox because neptazane has a greater action on the eye and less on the kidney.

DR. VAN HEUVEN remarked that he was happy to hear that Dr. Sugar still used the trephine on occasion.

DR. SUGAR said he felt that, in a residency program, all types of cataract and glaucoma surgery should be taught. He added that the resident would then use that operation which worked best in his hands. He added that the end-result of a well-done posterior lip sclerectomy would be as effective as a well-performed trephination.

DR. DONALD KAPLAN asked about the advisability of anticoagulants in venous thrombosis to prevent secondary glaucoma.

DR. SUGAR said he saw completion of central vein occlusion in spite of what appeared to be adequate anticoagulation because of factors unrelated to the anticoagulant in some cases.

DR. LEIB asked why pupillary block did not increase with the use of DFP or Humorsol in aphakic eyes.

DR. SUGAR said that, in aphakia, these drugs act by breaking adhesions only. In an early case the same result might be obtained by use of a strong mydriatic.

DR. SCHARD asked if there was danger to the hyaloid in the use of these drugs, as the drugs especially broke up posterior synechias.

DR. SUGAR said it was possible but not probable.

Stephen Troubalos,
*Recording Secretary.*

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## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 1, 1960

JOSEPH LAVAL, M.D., *presiding*

### OPERATION FOR SENILE SPASTIC ENTROPION

MARTIN BODIAN, M.D., presented a follow-up study of his previously reported operation for senile spastic entropin which he terms orbiculodiathermy. Fifty cases have now been operated by 14 surgeons.

The operative technique consists in: (1) novocaine injection along the entire lid; (2) application of an Erhardt clamp; (3) an incision parallel to lid margin, two-mm. below the lash line, through skin but not orbicularis, the entire length of the lid; (4) incision is undermined downward 8.0 to 10 mm. between skin and orbicularis; (5) orbicularis is cauterized with surface diathermy, hyfrecator or actual cautery along two rows of medium cauterization two and five mm. below the incision (the amount of cauterization can be graduated); (6) an elliptical strip of skin is excised from the lower margin of the wound three or four mm. wide at the center and tapering to the ends; (7) the wound is closed with silk or gut.

Restoration of normal function and appearance was achieved in 47 eyelids, (94 percent) by this operation. Three cases of overcorrection required massage for cure. Two cases resulted in overcorrection, producing ectropion. One patient was undercorrected.

Overcorrection can be avoided by exercise of restraint when cauterizing orbicularis oculi muscle. Should it occur, however, early rotary massage of the lid may achieve complete cure. Technique for massage consists in stretching the lid over the globe with the index finger for five minutes, three times a day, one week postoperatively.

Undercorrection is an uncommon result. It may be avoided by sufficient cautery at the time of surgery. Its presence requires reoperation.

### Causes of failure in retinal detachment surgery

Morton Rosenthal, M.D.: With present knowledge it is usually possible to estimate accurately chances of success in any given case and always possible to know the reason for failure when it occurs. Causes of failure are preoperative and operative.

Preoperative causes are mostly concerned with not finding all the holes. Every hole must be found and included in the operation. If only direct ophthalmoscopy is used, small peripheral holes will be missed. If scleral depression is not used, peripheral holes will be missed and some in the equatorial region will not be recognized as holes as they may look like hemorrhage or choroidal markings. Scleral depression helps identify them as holes. Even with indirect ophthalmoscopy and scleral depression care must be used to find holes in nondetached parts of the retina, and particularly in the 3- and 9-o'clock meridians where scleral depression is difficult. Other preoperative causes are failure or inability to handle such things as giant tears, multiple tears, fixed folds.

Operative causes are varied: (1) too much diathermy can cause macular folds. The hole should be accurately pinpointed with diathermy; the diathermy should be done through only a thin lamella of sclera and nonpenetrating electrodes should be used; (2) insufficient diathermy is a rarer cause; (3) poor operative localization of holes, or buckle narrower than hole (the operative effect should be checked visually and revised if necessary); (4) perforation of the retina by diathermy or by puncture for release of fluid; (5) prolapse of retina into scleral wound with loss of vitreous; (6) abrasion of retina by needle for vitreous implant; (7) retinal reaction to injection of air, saline or vitreous.

Alan H. Barnert,
*Corresponding Secretary.*

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## MEMPHIS EYE EAR, NOSE AND THROAT SOCIETY

### Homonymous hemianopsia with visual hallucinations

Dr. Philip Meriwether Lewis reported for diagnosis a case with an homonymous hemianopsia and visual hallucinations.

Mrs. I. D., a white woman, aged 78 years, was seen on January 5, 1959, because of severe headaches, flashes of light and the seeing of various nonexistent objects for a period of three weeks. Her general health was excellent and her physical examination was reported normal for her age.

Examination showed her eyes normal externally, incipient nuclear cataracts, a few vitreous floaters and moderate vascular sclerosis. Corrected vision was 20/30, R.E., and 20/40, L.E., J3. There was a left homonymous hemianopsia which was most marked in the lower quadrants. The right halves of the fields were normal except for an enlargement of the blindspot, R.E. Visual fields were exhibited. There was no papilledema.

The visual hallucinations consisted mostly of flashes of light but not infrequently she saw definitely formed objects, especially beautiful butterflies.

A tumor of the right temporal lobe was suspected and ventriculography advised. This was refused by the patient. As she was extremely nervous a tranquillizing drug was prescribed. Seven weeks later her son reported that her headaches and the hallucinations had ceased.

It is often quite difficult to distinguish between lesions of the temporal and occipital lobes, especially if they are on the right side of the brain. Temporal lobe tumors occur much more often and visual hallucinations consisting of definite objects, such as people or butterflies, are much more frequent than in tumors of the occipital lobes. In the latter case the hallucinations are more likely to consist of light flashes. However, sparing of the maculas which was present in this

case is more common in occipital lobe lesions. It is regrettable that further investigation has not been allowed.

### Endophthalmitis after glaucoma surgery

Dr. Abraham Cheij reported the case of I. L., a 51-year-old Negress who showed, when passed through the glaucoma detection program, on October 10, 1958, a high intraocular pressure: O.D., 34.2 mm. Hg; O.S., 34.2 mm. Hg with the 7.5 gm. weight.

Her past history was not remarkable, she had a partial mastectomy of the left breast on September 12, 1953, due to ductal papillomatosis. Vision was: O.D., 20/20, J4. O.S., 20/20, J4.

External examination was essentially negative. The media was clear. The funduscopic examination was negative except for the discs which showed a very deep cupping and some nasal displacement of the vessels. Central and peripheral fields were full. There was no enlargement of the blindspot. On November 4, 1958, a water drinking test was positive and showed an elevation in pressure from 22/22 to 37/48 mm. Hg. The scleral rigidity was slightly increased in the right eye. Gonioscopy was done with a Troncoso goniolens and showed a Grade II type of chamber angle, with visualization of the anterior and part of the posterior trabeculae. Multiple areas of dense deposition or clots of pigment were seen below. The patient was diagnosed as having chronic simple glaucoma, and placed on one-percent pilocarpine four times daily. She returned for follow-up at monthly intervals for a few times but missed some of her appointments. On December 9, 1958, the intraocular pressure was O.D., 27.4 mm. Hg; O.S., 31.8 mm. Hg. Pilocarpine was increased to two percent, four times daily and 0.25-percent eserine ointment at bedtime was added to the treatment.

On June 17, 1959, the intraocular pressure was still uncontrolled and pilocarpine was increased to four percent four times daily. On August 26, 1959 the intraocular pressure was: O.D., 30 mm. Hg; O.S., 35 mm. Hg Epitrate, was then added to the treatment. September 22, 1959, the intraocular pressure was: O.D., 44 mm. Hg; O.S., 44 mm. Hg. Fields showed a slight peripheral constriction. Gonioscopy showed the same pattern as before. Tonography was then done on September 25, 1959, and showed: O.D., $P_o$, 27; C, 0.26; O.S. $P_o$, 27; C, 0.18. The intraocular pressure was still uncontrolled, fluctuating between 28 and 44 mm. Hg according to the diurnal variations. A cyclodialysis operation on the left eye was recommended on October 23, 1959. The operative procedure and the immediate postoperative course were uneventful. Three days later, some haziness of the aqueous was noted, the eye was markedly congested and painful, and vision had decreased to hand motion only. The diagnosis of endophthalmitis was made and treatment was instituted immediately as follows: (1) polymixin B sulfate, 25 mg.; (2) penicillin, aqueous, crystallin, 500,000 units (subconjunctivally daily for four days); (3) penicillin, one million units intramuscularly four times a day; (4) Chloromycetin, 1.0 gm., intramuscularly immediately and by mouth four times daily; (5) Aristocort, 0.75 mg., four times daily; (6) atropine, one-percent solution and (7) Neohydeltrasol, 0.25 percent, instilled in the left eye every three hours.

The cloudiness of the aqueous became worse on the fourth postoperative day and the pupillary area was totally covered by a creamy white exudate which filled the chamber completely. X-rays films of the patient's teeth revealed an abcess of the left upper canine tooth, which was immediately removed and the abcess drained. On the eighth postoperative day, the exudate began to clear and the pupillary area was seen nasally. Drugs were gradually decreased and three weeks later there was only a minimal amount of exudate in the anterior chamber, temporally. The patient was discharged and kept on the same therapy at home. By November 16, 1959, approximately five and one-half weeks later, all exudate had disapppeared and the

eye was almost completely quiet. There were posterior synechias at the 12-o'clock position temporally. The media were clear with the exception of a few linear opacities in the anterior lens capsule. She was seen again four days later and the visual acuity had improved then to 20/70. One week later, the intraocular pressure in the left eye was 20.2 mm. Hg; the visual acuity had improved to 20/20; and the eye was quiet.

### Optic neuritis in iron deficiency anemia

Dr. Alice R. Deutsch presented the case of Miss R. W., aged 18 years, who was seen at the office for the first time on July 7, 1958. She complained of a sudden impairment of vision and headaches. She also gave the information that she had not felt well for about three months; her appetite was poor; she felt tired and she could not take part in any out-door activities. No physical examination had been made previously.

On examination no abnormalities were found in the position or motility of either eyeball. The pupils were equal and reacted to light. Both discs were blurred; the disc margins and the entrance of the vessels were veiled; hemorrhages were visible on the upper border of both discs. A swelling of 1.0D. was found over the upper temporal margin at the right disc, and of 2.0D. over the temporal superior margin of the left disc. Her corrected vision equalled 20/30 in each eye. The central fields showed a cecocentral scotoma and the peripheral fields were concentrically constricted. It was believed that those findings could be referred to an optic neuritis.

A physical examination and laboratory tests disclosed the presence of a severe hypochromic anemia: (RBC 3,100,000; hemaglobin 5.8 gm. percent; WBC, 6,200.) All other findings, including X-ray films of skull and sinuses, were negative.

Feosol, two tablets three times a day, was prescribed by her family physician and her general condition as well as her eyes improved rapidly. On September 5, 1958, her discs showed only a mild haze over the entrance of the vessels. Her corrected vision equalled 20/20 and her peripheral and central fields were normal.

The differential diagnosis between early papilledema and optic neuritis often is not easy. The absence of venous pulsation on mild pressure of the eyeball is not generally recognized as a differential diagnostic sign. The cloudiness of the prepapillary space as seen with the Hruby lens can only be ascertained in dilated pupils. Clinically the appearance of optic neuritis and papilledema is often indistinguishable. A swelling of the disc from 1.0 to 2.0 D. may also be associated with optic neuritis and severe disturbance of vision has been described with papilledema.

At the 1958 meeting of the American Academy of Ophthalmology and Otolaryngology, Dr. M. I. Lubeck discussed a case of papilledema caused by iron deficiency anemia which was practically identical with the case presented. A 14-year-old girl was admitted with the diagnosis of brain tumor. She had severe headaches, bilateral papilledema with a swelling of 1.0 to 2.0 D., enlargement of the blindspot, constricted fields and vision of 20/30. Lumbar puncture showed an opening pressure of 280 mm. $H_2O$; hemoglobin equalled 4.8 gm. percent. Iron therapy resulted in relief of all symptoms and disappearance of the papilledema. The increased intercranial pressure was referred to brain edema caused by the anemia. It was also emphasized that papilledema in primary microcytic hypochromic anemia (chlorosis, a practically extinct disease) was very rare and that only 11 cases were published in the literature, the last by Hamilton in 1936 in the *British Journal of Ophthalmology*. As the misdiagnosis of optic neuritis instead of papilledema might be of great significance in the handling of specific cases, especially in preservation of vision, this case was presented.

Eugene A. Vaccaro,
*Secretary, Eye Section.*

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## SCIENTIFIC TOOLS AND PROPRIETARY PREROGATIVES

Questions have been raised recently by optometrists in several states concerning the propriety and even the legality of American opticians using variations of instruments sometimes called "keratometers" or less accurately, "ophthalomometers." Such instruments are used to measure the radii of curvature of the front surface or cornea of the eye or similar, small, convex, mirrorlike surfaces. These instruments are based on three fundamental principles: (1) the convex mirror characteristic which reduces the size of a reflected object in proportion to the reduction in its radius of curvature, (2) the astronomic telescope, and (3) the astronomic technique (doublement) of a double image micrometer for measuring short arcs

(angular distances) in the celestial system.

The first fundamentals were elicited in particular reference to the cornea or front surface of the human eye by a Jesuit mathematician and astronomer, Father Christoph Scheiner (1575-1650), who was educated, and later taught, in many middle European areas. The principles and origins of the telescope are too well known to reiterate here.

The technique of doubling and quantitatively separating images of an object in order to measure angular distances was first used in astronomy to overcome difficulties of accurate measurement while objects are in motion. Such telescopes with doubling devices (later, Wollaston prisms) were originally called "heliometers" and used to measure diameters on the sun. The first of these were designed by Servington Savary (1743) and Pierre Bouguer (1748). Subsequently these instruments have been used for measuring short angular distances between stars and are among the most accurate astronomic instruments.

The first practical heliometer was devised in 1754 by John Dollond of London and his son, Peter, an optician and instrument maker. Dollond was a mathematician, physicist, and later (1761) appointed "Optician to the King." A later model, made in London by Thomas Young and his optician, Cary, caught the imagination of the German physiologist Herman Helmholtz who, in 1854, used the principle of doublement awkwardly to measure the corneal curvature. He used an open flame for an image source and placed his subject several feet away for viewing the eye through a small telescope. More practical models were constructed by Laurent, Coccius, and Mandelstamm and Schoeler, but the first really compact clinical model was adapted by the Parisian ophthalmologist Emile Javal and his Norwegian pupil Hjalmar Schiøtz in 1881. They used the French astronomic term "mire" meaning a "meridian mark" to indicate their lighted image source. An "improved model" of 1889 was exported and subsequently modified by many workers.*

These instruments actually measure the radius of curvature of the front surface of the cornea in linear units, usually millimeters. Some instruments have conversion scales attached which indicate approximate dioptric values of these curves. These expressions are not at all absolute and are based on the assumption that human corneal tissue has a presupposed, average, refractive power (index of refraction 1.3375, Javal and Schiøtz). These instruments do not, however, in spite of any conversion figures attached to them, measure the dioptric or refractive power of any specific cornea.

Suggestions that measuring instruments such as the keratometer should be used by only one group of people in this or any other nation are not tenable. If use were restricted, historically it should be restricted to astronomers, opticians, physicists, and physicians. In man's constant zeal to measure and quantitate his world and the universe about him, there can be no restriction on the use of rulers, telescopes, gauges, keratometers or other scientific instruments to any group of people by any nation or by any profession.

Arthur H. Keeney.

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## OPHTHALMOLOGY AND SCHOOL HEALTH

From the beginning of specialization in medicine, ophthalmology has contributed much to the advancement of medicine. Ophthalmology was the first branch of American medicine to provide for certification of specialists. The American Board of Ophthalmology, established in 1916,[1] set the pattern which served for the development of all other specialty boards, the next two

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* Kaganaarm, Brudzewski, Sutcliff, Spiller, Hardy, Reid, Sulzer, Eriksen, Gullistrand, Souter, Davis, Valk, Chambers, Inkeep, Dannett, Oliver, and others.

following in 1924 and 1930. In public health matters, ophthalmology has a long history. The work of Credé in 1874 was a milestone in preventive medicine.

In the matter of school health, the vision of the school child received early attention. Initial efforts were directed toward an attempt to prevent the progress of myopia. In the appraisal of the health of school children, the detection of impaired vision has received primary consideration.

The history of regular and scientific school eye health services begins with efforts to standardize and critically analyze methods of detection of eye defects. The widely accepted so-called "Massachusetts Vision Test," devised in 1940,[2] incorporated visual acuity testing, heterophoria testing, and the use of the convex lens test for the detection of hypermetropic refractive errors.

The St. Louis study published in 1954,[3] in which visual screening methods were evaluated and compared with certain clinical ophthalmologic standards, proved a great stimulation to school eye health services. Since that time, a number of statistical evaluations of the validity and efficiency of eye screening procedures have been done by ophthalmologists and by public health personnel. The need for the help of the ophthalmologist continues and is recognized almost more by nonophthalmologists than by many ophthalmologists themselves.[4]

Lay organizations, for example, the National Society for the Prevention of Blindness, have adopted promotion of eye screening procedures as a major part of their program. A complete representation of all groups having an interest in children was assembled in the White House Conference on Children and Youth held in the spring of 1960 in Washington, D.C. The results of the White House Conference prove the profound interest of the entire population in eye problems of children.[5] Many resolutions of the Conference deal with medical problems, including those involving eye care.

Medical organizations, such as the Bureau of Health Education of the American Medical Association, have endeavored to close the gap between physician and educator in the execution of school health programs.[6] Medicine must accept the responsibility to lead in the formulation of good school health appraisal methods. Selection of goals of appraisal, of equipment to be used, and of referral standards are *medical* functions.[7-9]

The National Medical Foundation for Eye Care was formed in 1956 for the purpose of gathering and presenting "to the public generally and to the medical profession, pertinent information on the care and treatment of the eyes."[10] Ophthalmologists had need for such an organization through which they could express their views and establish policy. The Foundation permits organized ophthalmology to deal directly with public health problems pertaining to eye care. One of the important projects of the Foundation has been the publication of the report entitled *Identification of School Children Requiring Eye Care*.[9] This report, which outlines the standards of good eye care, represents the composite thinking of a cross-section of American ophthalmologists. In addition to supplying necessary information to the public, this report stimulates the interest of the ophthalmologist in the promotion of good care for the public as a whole, supplementing his provision of medical services for the individual eye patient. This nationwide medical study, the first to set forth the nature of the problem, stresses the relation of an eye health program to a general medical health program in the school and in the community. It reviews and develops the physiologic bases for screening.

A recent study in one state[11] advocates screening which the ophthalmologists in that state[12] consider debatable and which have been challenged by the ophthalmologists whose names appear as co-authors.[13] The opinions of ophthalmologists on what ocular disabilities require eye care and on the standards for referral[14,15] differ, and the question of the adequacy, reliability and effec-

tiveness of stereoscopic self-contained vision test equipment compared to the visual acuity, hyperopia, and heterophoria testing of the Massachusetts Vision Test, or with clinical test methods, has not yet been finally settled.[16]

More active participation by ophthalmologists in school eye health programs is recommended by national, state and local ophthalmic organizations. Your help is needed.* Otto Lippmann.†


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* Helpful pamphlets and other material are available through the National Medical Foundation for Eye Care, 250 West 57th Street, New York 19, New York.

† Otto Lippmann, M.D., Austin, Texas, chairman, School Health Committee, National Medical Foundation for Eye Care.

## OBITUARIES

### HENRY P. WAGENER
### (1890-1961)

Dr. Henry Patrick Wagener, well known for his contributions to medical ophthalmology and an emeritus member of the staff of the Mayo Clinic, died on April 27, 1961, in Rochester, Minnesota, of coronary sclerosis.

Born in Charleston, South Carolina, on June 3, 1890, he received the degree of bachelor of science from Charleston College in 1909 and that of doctor of medicine from the Medical College of South Carolina in 1913. During World War I he served as an officer in the Medical Corps of the American Expeditionary Forces. He entered the Mayo Foundation at Rochester, Minnesota, as a fellow in ophthalmology on January 1, 1920, and received the degree of master of science in ophthalmology from the University of Minnesota in 1923. He was named first assistant in 1921 and was appointed to the staff of the Mayo Clinic in 1926 as a member of the Section of Ophthalmology. After he retired in 1955, he continued to devote himself to writing and to the preparation of an occasional lecture.

Dr. Wagener was certified by the American Board of Ophthalmology, Inc., in 1926. He was a member of the American Academy of Ophthalmology and Otolaryngology, the American Ophthalmological Society, the American Medical Association, the Medical Society of South Carolina, the Southern Medical Association, the Minnesota Academy of Ophthalmology and Otolaryngology and the Society of the Sigma Xi. He was

HENRY P. WAGENER, M.D.

president of the Minnesota Academy of Ophthalmology and Otolaryngology in 1941 and 1942.

He is survived by his wife, the former Sabina Waterfield, two daughters and a brother, Dr. A. P. Wagener of Williamsburg, Virginia.

Dr. Wagener was a popular speaker and was author of approximately 110 medical papers. His chief interest was in the field of vascular disease, and his writings dealt especially with the ocular changes in hypertension, diabetes and temporal arteritis. Less frequently he wrote on some phase of neuro-ophthalmology. He and Dr. Norman M. Keith, an internist of the Mayo Clinic, were especially interested in classifying hypertensive disease for the purpose of prognosis. The classification they devised proved useful, yet it was regarded as tentative by both of them, for they were fully aware of the gaps in basic knowledge of the disease processes they were observing.

Dr. Wagener had the opportunity of devoting most of his professional life to medical ophthalmology. He took advantage of that opportunity, and within this subspecialty established a reputation as a respected writer and teacher.

C. Wilbur Rucker.

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## JOSEPH RINGLAND ANDERSON
## (1894-1961)

The death of Joseph Ringland Anderson on May 14, 1961, removed a distinguished member of the medical profession with a fine record of service.

Ringland Anderson was born in Victoria on October 29, 1894. He was educated at Scotch College, Melbourne, and Melbourne University, graduating in 1916, after which he served in the First World War in the Australian Army Medical Corps in France, and was awarded the Military Cross. In the Second World War he was a Squadron Leader at R.A.A.F. Headquarters. His de-

JOSEPH RINGLAND ANDERSON, M.D.

grees included a Melbourne M.D., Fellow of the Royal College of Surgeons (Edinburgh) and a Fellow of the Royal Australasian College of Surgeons.

For many years he was senior ophthalmic surgeon at the Alfred Hospital. He played an part in the founding of the Ophthalmological Society of Australia, of which he was president in 1946, and in the Ophthalmic Research Institute of Australia, and a prominent part in the establishment of a Chair of Ophthalmology at the Melbourne University.

He attended three International Congresses, twice as a representative of the Federal Government and once as a representative of the Ophthalmological Society of Australia. Dr. Anderson did pioneer work in retinal detachment, also in orthoptics in the treatment of squint.

He is survived by his wife and two daughters, whose loss is shared by his many colleagues of the Ophthalmological Society.

Esmé V. Anderson.

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## CORRESPONDENCE

### Correction: Uveitis survey

Editor
American Journal of Ophthalmology:

May I call attention to an erratum in the paper by Dr. Abrahams and me on the "Uveitis survey" published in the May, 1961, number of The Journal?

On page 773 it is stated that five types of the Group A of the beta streptococci isolated by Dr. Lancefield are not included in the present Academy Diagnostic Kit. It was suggested that these be obtained and added to new kits now in the course of preparation. The missing types were Nos. 7, 16, 20, 21 and 45.

Subsequent correspondence with Dr. Lancefield has revealed the fact that three of these types, namely Nos. 7, 20 and 21 were found to be members of Groups C. Type 16 was similarly found to be members of Group G, while type 45 was finally identified as identical with type 24, already in the kit. For these reasons, these types were omitted when Dr. Lancefield originally supplied the 42 strains now represented in the kit. However, one new type, No. 48, has recently been discovered which will be added to future kits.

This information was obtained too late to make the necessary correction in the proof before publication. I regret the error, which is entirely my responsibility.

(Signed) Alan C. Woods,
Baltimore.

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### Keratitis medicamentosa

Editor
American Journal of Ophthalmology:

I am interested in Dr. Michaelson's letter reporting keratitis after the use of a topical medicament (Am. J. Ophth., **51**:723-724 [Apr.] 1961). I have been interested in this problem for several years now. Many other ophthalmologists have noted the same occurrence.

It is evident that topical medication can produce a superficial punctate keratitis, localized to the palpebral fissure area. More commonly it occupies the lower palpebral fissure area, and may even present a demarcation line between the lesions and the clear cornea. The lesions are usually fine and branny, but may be crumblike or filiform in appearance, and are superficially located in the epithelium. The lesions may occur in one eye only even when both are on the same medication. An associated circumcorneal injection is not always present, nor is there enlargement of the preauricular node.

I have seen a number of such cases during the past several years. At first, the significance of these lesions was missed, and some were undoubtedly labelled as "superficial punctate keratitis due to adenovirus." These cases followed prolonged use of many different topical steroids, steroid-antibiotic combinations, pilocarpine and various antibiotics. The lesions disappear on stoppage of the medication and may disappear on a change of brand of the same medication or even despite continued usage. There have

been no instances of recurrence of the keratitis following re-institution of the presumably causative medication, after the original keratitis had disappeared.

Mitsui* and his group attribute these cases to topical prednisolone. Most of my cases occurred during a period in which my usage of topical prednisolone was at a minimum.

The term "keratitis medicamentosa" seems an appropriate one for this condition. For that reason one should question every patient with superficial punctate keratitis concerning prior use of topical medication.

With such a diverse group of drugs inciting a similar corneal picture, it would seem logical to attribute the keratitis to some such common denominator as the components of the diluent. I thought that I had finally pinned down the cause to one antiseptic agent, only to discover that one decongestant which I have freely used with nary a keratitis contains this agent. On another occasion a doctor's wife was doing well on a topical steroid, only to come down with a red eye and a "keratitis medicamentosa" when I gave her a sample of the same steroid, now combined with an antibiotic. So I still don't know what causes it.

(Signed) Dan M. Gordon,
New York.

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### Sectioning the optic nerve

Editor
American Journal of Ophthalmology:

Enucleations, although not now as frequently done as formerly, are still occasionally necessary. After the optic nerve has been severed and the globe removed, it may be desirable for the patient's welfare or the surgeon's repose, that an additional section of the optic nerve be excised.

This is sometimes difficult as the nerve end appears to retract until the searcher, through the bloody mass of orbital contents, usually feels considerable frustration. The nerve end is found very easily by slipping a 13 by 150 mm. test tube into the muscle cone. With the operating light shining down the tube, the nerve in its surrounding sheath becomes distinctly visible at the bottom of the tube. A curved mosquito forceps is then easily slid down the side of the glass tube and the visible nerve end grasped. An additional section of the nerve can then be easily severed. If a still longer section of the nerve is needed, the process can be repeated.

(Signed) William L. Ridgway,
San Francisco.

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### The Orinda Vision Study

Editor
American Journal of Ophthalmology:

The February, 1961, issue of The Journal contains a letter in the correspondence section by Jerome W. Bettman, M.D., and Victor G. Fellows, M.D. regarding The Orinda Vision Study. Dr. Bettman is a coauthor, together with Henrik L. Blum, M.D., and Henry B. Peters, M.A., O.D., of "Vision Screening for Elementary Schools: The Orinda Study" published by the University of California Press, 1959, and both of these gentlemen served on the study staff of this research project. Their comments remind me that the purposes and facts about the Orinda Vision Study do not change and that they bear repeating.

The purposes of the study included designing a screening procedure which would refer any child that eye specialists felt should have the benefits of professional observation, irrespective of whether therapy was finally to be recommended or not.

Both the participant ophthalmologists and those they canvassed (quoted on *page 95* of the Orinda Vision Study) established the referral criteria against which the screening tests were measured. If these criteria are the ones that an ophthalmologist believes would dictate whether his children, or any child

* Mitsui, Y., et al.: Ophthalmologica, **139**:461, 1960.

should be professionally seen, and ophthalmologists have said so categorically, then this is what screening tests should be capable of revealing. Whether it is always a serious defect needing therapy or not, these limits indicate those defects which might be serious and that is presumably why ophthalmologists gave us these referral criteria.

Since we kept minutes of all our meetings, it is of interest that on August 13, 1955, we discussed the very small group of questionables in these terms: "The 'Questionable' referral category is rather small (57 of 1,163). When each person so labeled by the clinicians is considered in the light of the criteria the same clinicians have obviously used, about one-half the 'Questionables' group becomes 'Correct' and the remainder 'Incorrect'."

The questionable group turned out to be 'questionable' in everyone's mind, that is, children at the cut-off point, and since any screening test has a cut-off point, there will always be some borderline cases. Since there was agreement as to their questionable or borderline status, and no disagreement as to advised therapy, there was no longer any purpose or opportunity to pursue a test of matched pairs of treated vs. untreated.

I have a little trouble understanding the statement about the timing of publication, since all of us as a group, including many of the consultants, worked many long evenings going over the publication, chapter by chapter, sentence by sentence, and word by word.

We can only refer to our joint recommendations for setting up a school vision study on *page 102* to realize that we foresaw need for much leeway and scrutiny in planning, carrying out and evaluating such a program, community by community.

(Signed) H. L. Blum,
Health Officer, Contra Costa County,
Martinez, California.

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## Handle for electro-keratotome

Editor
American Journal of Ophthalmology:

In the March, 1961, issue of The American Journal of Ophthalmology Dr. A. Benedict Rizzuti reports on page 524 what he calls a modified handle for the electro-keratotome. This is the instrument I first reported before the Section of Ophthalmology of the New York Academy of Medicine on December 16, 1957, and at the 94th annual meeting of the American Ophthalmological Society at White Sulphur Springs, West Virginia, in June, 1958.

Dr. Rizzuti was informed verbally and in writing on May 13, 1960, by the manager of the Storz Instrument Company New York sales office that the cylindrical handle he was suggesting was already the only type available for use with the electro-keratotome and had been for over four months before he submitted his article for publication in The American Journal of Ophthalmology on April 22, 1960. This, of course, invalidates his claim of priority in the use of this motor for electro-keratotome.

In the last paragraph of his report Dr. Rizzuti states that using the new cylindrical handle two lamellar grafts of different size and thickness can be removed with greater facility. This statement is inaccurate. The only part of the instrument that comes in contact with the eye is the head of the electro-keratotome containing the cutting blade and the gauging mechanism to measure the thickness of the lamellar graft and the head of the instrument performs equally well if it is activated by the old type motor, the new cylindrical one or any one of 10 other prototypes, including one operated by a pull cord that does not require electricity. This last motor was reported at the International Congress of Ophthalmology in Brussels in 1958.

(Signed) Ramón Castroviejo,
New York.

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### Dr. Rizzuti's reply

Editor
American Journal of Ophthalmology:

In answer to Dr. Castroviejo's letter concerning the matter of my article entitled "Modified handle for electro-keratotome," I wish to clarify the following facts:

1. The article specifically refers only to a modification of a cylindrical handle which was adapted to the head of Dr. Castroviejo's electro-keratotome and was not intended to detract from his instrument which he first reported before the Section of Ophthalmology of the New York Academy of Medicine on December 16, 1957.

2. The same cylindrical handle was modified by one of our local opticians to fit the head of Dr. Castroviejo's electro-keratotome and the work was completed early in November, 1959. I still have in my possession the original model. This modification was brought to the attention of the Storz Instrument Company, and they clearly stated to me at that time that they had no similar type handle available but were contemplating making a somewhat similar modification some time in the future.

3. The cylindrical handle described is originally a product which for some time has been manufactured by the North American Philips Co., Inc., Norelco Shaver Division. This reference was mentioned in the article.

4. The main purpose for submitting my article was to point out the feasibility of using the cylindrical handle in performing lamellar keratoplasties. In my hands, it was possible to obtain two thin lamellar grafts from a single donor cornea. In view of the great availability of donor material, this particular point is of little consequence.

(Signed) A. Benedict Rizzuti,
Brooklyn, New York.

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## BOOK REVIEWS

The Year Book of Ophthalmology (1960-1961). Edited by William F. Hughes, M.D. Chicago, Year Book Medical Publishers, 1961. 375 pages, 84 illustrations, subject and author indices. Price: $8.50.

The review article this year is by the editor himself on the ever-timely subject—management of uveitis. Its 28 pages are crammed with practical, up-to-date clinical information. Gonorrheal iritis, which is still not too rare, is among the few omissions. In inflammation confined to the anterior segment, Hughes administers corticosteroids only locally and lists in order of effectivity methylprednisolone, dexamethasone triamcinolone, prednisolone, hydrocortisone and cortisone. Though atropine must be used, the pupil should not be in continuous maximal dilatation lest posterior synechias form peripherally. To the chemotherapy of ocular tuberculosis he would add pyridoxine, 25 mg. twice daily, to balance the urinary loss induced by isoniazid. Whenever the administration of corticosteroids or carbonic acid inhibitors is prolonged, potassium deficiency must be counteracted. Intravenous typhoid vaccine is advised when the corticosteroids fail or are contraindicated.

The editorial comments by Hughes and his consultants (Walsh, Thygeson, Haas, Moses, King, Krill, Noell, Constantine) are apt and authoritative but much more sparingly distributed than in previous volumes of this series. In the ample and lucid abstracts, the following subjects receive the current spotlight: enzymatic zonulolysis, photocoagulation, pleoptics, corneal anaphylaxis, ophthalmodynamometry, contact lenses, A-V syndrome, electron microscopy, anterior-chamber lenses, retinal detachment, chronic glaucoma, malignant exophthalmos, toxoplasmosis, and diabetic retinopathy.

The reader will find this volume to be not only a useful review of recent ophthalmic literature throughout the world but also a

readily accessible and valuable source of reference.

James E. Lebensohn.

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TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY. Ninety-sixth annual meeting, Colorado Springs, Colorado, May 16-18, 1960. Published for the Society by the University of Toronto Press, 1961.

In addition to the minutes of the executive session, obituaries of deceased members, and directory of the membership this *Transactions* of the 1960 meeting of one of the world's oldest and most distinguished ophthalmologic societies carries the text of 19 original papers and three accepted theses by candidates elected at the meeting. Three new instruments presented by Castroviejo are described.

At the opening scientific session Dr. Albert E. Sloane (with Perry Rosenthal) discussed the problem of school vision testing and urged that a national committee be appointed to establish clinical criteria and provide leadership to all groups interested in this field. Dr. T. E. Sanders reported on 20 cases of intraocular juvenile xanthogranuloma, characterized by iris tumor, spontaneous anterior chamber hemorrhage, and secondary glaucoma in an infant. For this condition, which he felt to be more common than had been supposed, X-ray therapy was suggested. Dr. A. G. DeVoe related his experience in the prolonged use of corticotropin and adrenal steroids in a case of sympathetic ophthalmia. Dr. Banks Anderson (and Banks Anderson, Jr.) reported three cases of severe uveitis developing in patients under treatment with intracranial perfusion of nitrogen mustard for inoperable brain malignancy. Dr. B. D. Leahey made a plea for early surgical correction of concomitant esotropia based upon successful results in his experience. Dr. John McLean (and M. A. Galin) described experimental work regarding the effect on intraocular pressure of reduced blood osmolality. Localized myxedema and amyloidosis were discussed by Dr. G. Picó as causes of chronic pseudo-tumoral edema of the conjunctiva.

At the second session of the meeting Dr. F. Blodi and colleagues reported a case of lipid-proteinosis with characteristic lid involvement. This rare disease, described by Urbach and Withe, has been known to dermatologists and laryngologists but has not been reported in the ophthalmic literature. Dr. M. J. Hogan and his co-workers presented the results of electron microscopic studies of Toxoplasma.

Two papers on congenital cataract, presenting the argument of needling versus linear extraction, with Dr. Ira Jones and Dr. Frederick Cordes as protagonists, called for considerable discussion. One is impressed with the fact that throughout the meeting the informal discussion of papers is often as valuable as the original presentation, constituting one of the most educational features of the American Ophthalmological Society.

A new classification of glaucoma was presented by Dr. R. Shaffer; digital ocular compression preceding cataract surgery was analyzed by Dr. H. Hildreth; Dr. A. J. Bedell presented a kodachrome clinic on bilateral progressive chorioretinitis. The session closed with a timely paper by Drs. Hogan, Thygeson, and Kimura on the unfavorable effect of topical steroid therapy on herpetic keratitis.

At the final scientific session Dr. G. N. Wise discussed retinal arteriosclerosis secondary to uveitis. Dr. L. Christensen discussed epithelization of the anterior chamber after cataract extraction. Dr. H. Burian, et al., presented a paper on chamber angle anomalies in systemic connective tissue disorders. Dr. A. E. Maumenee presented the final paper on external filtering operations for glaucoma.

Not the least significant contributions to be found in the *Transactions* are the candidates' theses. The only ophthalmologic society, at least in America, to require an ac-

ceptable thesis for admission to membership (by no means a mere formality), the American Ophthalmological Society has thus stimulated many great contributions to the ophthalmic literature. In this current volume are included the following: "Hypothermia and aqueous dynamics of the rabbit eye" by Dr. Bernard Becker; "The aqueous filtration angle" by Dr. L. L. Calkins; and "Toxoplasmic retinochoroiditis" by Dr. J. V. Cassady. A fourth accepted thesis on "The electrophysiology of extraocular muscles with special reference to electromyography" by G. M. Breinin is to be published in book form by permission of the Council.

The *Transactions* is well printed, accurately edited and illustrated, and contains many valuable contributions to the specialty. It is unfortunate that it is not always readily available to a larger segment of ophthalmologic readers.

William A. Mann.

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TRANSACTIONS OF THE PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY. Volume XLI, 1960. Edited by Earle H. McBain, M.D. 400 pages with additional roster of members and index.

The character of the papers on ophthalmological subjects presented at the 44th annual meeting of this outstanding West Coast specialty society is well up to the high standards set at previous meetings. In addition to papers devoted to oto-laryngology, obituaries, lists of instructional courses, constitution and by-laws, business reports, and a roster of the memberhip, there are 12 papers of interest to the ophthalmologist. The volume is well edited, excellently printed, and profusely illustrated.

E. J. Wylie, in a discussion of cerebrovascular insufficiency due to extracranial arteriosclerotic disease, suggests that all patients over the age of 40 years who develop neurologic disorders should be investigated for possible vascular occlusion. More reliance is placed on angiography than ophthalmodynamometry, which is frequently disappointing. Headache mechanisms are discussed by A. M. Ostfeld, who states that the most common type is the muscle contraction headache with consequent ischemia due to vasoconstriction. R. P. Burns reports on ocular infection by Pseudomonas in the newborn as a potentially lethal disease. If the organism is sensitive to polymyxin B, he urges that a higher concentration of solution be employed than found in commercial ointments; internal medication, if used, should necessitate frequent urinalysis for kidney damage.

Milton Flocks describes his interesting experiments in simultaneous color contrasts, which appear compatible with the Young-Helmholtz theory of color vision and explains the phenomena described by Land. His theory is of great interest and must be read in entirety to be intelligible, but his theory in brief is based on stimulation of adjacent areas of the retina when viewing an object in color. E. S. Perkins of London relates a high incidence of prostatic infection and frequent joint symptoms in cases of acute uveitis in the male and suggests a possible common etiology.

Colyear and Pischel review 160 cases of retinal tears seen without detachment of the retina, 30 of which were treated with diathermy and 88 by photocoagulation. The latter was felt to be a safer and easier method. They found that untreated tears eventually resulted in detachment of 29 percent of cases. Campion and Ranker present a clear exposition on pleoptics. Manuel Allende describes dermatologic lesions affecting the eye. Participating in a symposium on uveitis are Thygeson, Helen Foerster, Hogan, Kimura, Epstein and Perkins, with emphasis on toxoplasmosis and virus diseases. E. S. Perkins in a paper on glaucoma in the younger age group considers that pigmentary glaucoma is part of a large syndrome of developmental defects in the outflow channels due to a malformation found most commonly in

myopic males. W. F. Hoyt describes vascular lesions of the visual cortex with brain herniation though the tentorial incisura. The final paper, by Straatsma and Allen, is concerned with retinal and vitreous abnormalities related to retinal detachment.

William A. Mann.

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RE-EDUCATIVE TREATMENT OF SUPPRESSION AMBLYOPIA. By T. Keith Lyle, M.D., Cynthia Douthwaite, D.B.O., and Jill Wilkinson, D.B.O. Baltimore, Williams & Wilkins Co., 1960, 135 pages. Price: $5.00.

In suppression amblyopia the results from occlusion, orthoptics or pleoptics can be maintained and improved by the ingenious graduated home exercises presented in this excellent book. This volume is an abridged English version of Jean Sédan's *post-cure de l'amblyope rééduqué* (229 pages), published in 1958, which in turn was an elaboration on the 93-page book on *Monocular Vision Training* by Mrs. Mildred Smith Evans, head of the Orthoptic Clinic in the Wilmer Institute, published in 1946. The intrinsic interest of the exercises and their extreme variety insure attention and an avoidance of boredom. Alertness is maintained by proofreading of incorrectly printed texts in types descending from 48 to 4-point; by counting letters and figures; by checking arithmetical miscalculations; by detecting differences between apparently similar drawings or photographs; and by completing jig-saw patterns. An additional device involves completing designs after tracing on transparent paper the dots of patterns of increasing complexity. For the after-care of eccentric fixation, vision is exercised with letters so disposed in a linear direction that they provoke the least difficulty in spatial judgment. Since the point of fixation is usually displaced from the fovea in a purely horizontal direction, the use of letters in vertical lines is most often indicated as the starting exercise. Eye-ear-hand co-ordination is promoted by instructing the patient to read aloud while pointing to the letters in the diagrams.

In the review of Sédan's book (THE JOURNAL, **46**: 761-762 [Nov.] 1958) an English adaptation of his work was suggested as very worth while. Lyle and his associates have done this admirably. The English version is an improvement; besides being in hard covers and more reasonably priced, the material for proof-reading begins with much larger type, 48-point (equivalent at 13 inches to 20/400 acuity) and the text throughout is all from the same source, *Alice in Wonderland*. The story in its various sizes of print is not only well adapted to its primary purpose but can be of service whenever a practical reading test is indicated; and should be particularly valuable in checking the reading ability of low-vision cases with optical aids.

James E. Lebensohn.

CURRENT THERAPY. Edited by Howard F. Conn, M.D. Philadelphia and London, W. B. Saunders Company, 1961. 806 pages. Price: $12.50.

This new 1961 edition of a well-known book on practical therapy contains the opinions of over 300 collaborators on the treatment of a wide variety of diseases, none of which have any direct significance to the practicing ophthalmologist except as he may have concern for the modern therapy of nonophthalmologic conditions. For a reference work in this connection and for the convenient tables of normal laboratory findings and treatment of poisoning it may have some value but it is disappointing that more attention is not paid to ocular therapeutics.

William A. Mann.

# ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

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## 1

### ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Seitz, R. and Sautter, H. **Morphological investigations into the fine architecture of the terminal optic nerve blood vessels in the vicinity of the disc.** Ophthalmologica **141**:17-32, Jan., 1961.

There is a considerable confusion in the literature regarding the presence or absence of epithelioid, glomus-type cells in the retinal and choroidal blood vessels. To clear the matter up, the authors have studied 18 enucleated human eyes; in all 18 of these eyes the epithelioid cells in question were found. Where demonstrable, they appeared to be present actually within the laminae of the vessel walls; they were characterized by swelling and vacuolation, often protruding into and considerably narrowing the lumen of the vessel. Longitudinally they occurred in chains, and in cross section, they encircled the vessels like a cuff. They were discovered in two locations only, and, in both instances, only in the immediate vicinity of the optic nerve head. In the first eye they were seen in the small vessels emerging from the central retinal artery near the cribriform plate; in the second, in the small vessels branching off the circular scleral artery of Zinn. Previous studies had demonstrated the abundant anastomoses between these two groups of vessels and it was assumed that the epithelioid cells represented glomus-cell-like devices for regulating arterio-arterial shunts between the retinal and ciliary blood vessels. The significance of these observations is briefly discussed. (11 figures, 32 references) Lawrence T. Post.

## 2

### GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Pannarale, M. R. **Researches on the sensitivity to antibiotics of strains of Micrococcus pyogenes isolated from the conjunctiva and eyelids of carriers in a hospital envirenment.** Boll. d'ocul. **39**:430-443, 1960.

The author compared the sensitivity to antibiotics of fifty strains of coagulase- and mannitol-positive staphylococci isolated from the conjunctiva of carriers in a hospital environment, with those of staphylococci isolated from the conjunctiva of out-patients. Marked differences were found in the resistance between these two strains of staphylococci. Thirty-

two percent of the out-patient staphylococci were found to be resistant to antibiotics, whereas 70 percent of hospital strains of staphylococci were found to be resistant. The greatest resistance appeared to be to Penicillin and to Penicillin and Streptomycin. The significance of these findings in the treatment of patients with staphylococcal ocular infections is discussed. (4 tables, 57 references)

Joseph E. Alfano.

Pannarale, M. R. and Lanzieri, M. **Comparative study on the sensitivity of micro-organisms of the ocular flora to 15 antibiotics. (Remarks on the use of antibiograms in ophthalmology.)** Boll. d'ocul. **39**: 395-415, 1960.

The authors cultured the conjunctival sac of normal individuals and of patients with active ocular infections and determined the sensitivity of these organisms to various antibiotics. Among the organisms cultured were staphylococcus, streptococcus, pneumococcus, neisseriae, tetragenous, sarcinae, Bacillus subtilis, corynebacteria, haemophili of the conjunctiva, Morax diplobacilli, b. coli and aerogenous, alkaligenous, pyocyaneus and proteus bacilli, as well as a strain of Candida albicans. They found the gram negative staphylococci and Bactericae to be particularly resistent. (7 tables, 54 references)

Joseph E. Alfano.

Theodore, F. H. **Bacterial allergy of the eye.** Tr. Am. Acad. Ophth. **65**:184-196, March-April, 1961.

Hypersensitivity to micro-organisms and auto-allergy are considered the most important forms of ocular allergies. The former may affect all the ocular and adnexal tissues. It is manifest as a local, focal, or systemic reaction, but anaphylaxis does not occur in man. Delayed (tuberculin type) reactions are the commonest; the immediate (wheal type) is rare. A third eczematous type reaction may occur. That antibodies are found in the cells rather than the blood is unimportant, since there is no passive transfer.

The hypersensitivity is not only to bacteria, but to viruses, fungi, parasites, endotoxins and exotoxins. The important bacterium is the staphylococcus because of its exotoxin and the chronicity of its reaction.

The microbial-allergic reactions affecting the various ocular tissues are listed and described regionally. The highlights are tabulated. (5 tables, 22 references)

Harry Horwich.

## 3

### VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

DelPlanto, E., Valesini, G., Gozzoni, F. and Catalino, P. **Thioethyl chaulmoograte in experimental eye tuberculosis of the rabbit.** Boll. d'ocul. **39**:352-361:1960.

The authors evaluated the effects of the drugs thioethyl chaulmoograte and thioethyl chaulmoograte plus 4-4′ diaminodiphenylsulphone in the treatment of an active ocular tuberculosis in rabbits. They found both drugs to be effective in proportion to the dosage used. (2 figures, 2 tables, 21 references) Joseph E. Alfano.

Dobbie, G. C. and Langham, M. E. **Reaction of animal eyes to sanguinarine and argemone oil.** Brit. J. Ophth. **45**:81-95, Feb., 1961.

The alkaloid sanguinarine is a constituent of Argemone mexicana. The clinical condition of epidemic dropsy with an increased incidence of glaucoma is due to contamination of cooking oils with argemone oil. Intravenous and intraventricular injections of sanguinarine caused a transient rise in the intraocular pressure. Repeated injections failed to cause a sustained increase in pressure. (8 figures, 1 table, 20 references) Irwin E. Gaynon.

Gettes, B. C. **Tropicamide, a new cycloplegic mydriatic.** A.M.A. Arch. Ophth. **65**:632-635, May, 1961.

This study shows that tropicamide

(Mydriacyl) in one-percent solution is an effective cycloplegic if more than one drop is instilled and the refraction done 20 to 35 minutes after the second instillation. It is not a reliable "one drop" cycloplegic. (2 figures, 2 tables, 8 references)
Edward U. Murphy.

Haddad, H. M. and Becker, B. **Distribution of sialic acids in the human eye.** A.M.A. Arch. Ophth. **65**:563-564, April, 1961.

Sialic acids are abundant in the cornea, lens and retina, and less so in the posterior vitreous. (1 table, 6 references)
Edward U. Murphy.

Hanna, C., Bicknell, D. S. and O'Brien, J. E. **Cell turnover in the adult human eye.** A.M.A. Arch. Ophth. **65**:695-699, May, 1961.

Tritium-labeled thymidine was used to study the production and migration of cells in animal and human eyes. (1 figure, 8 references) Edward U. Murphy.

Irinoda, K. and Konta, S. **Experimental studies on ocular manifestations of choline deficiency.** Jap. J. Ophth. **5**:21-31, Jan.-March, 1961.

In the choline-deficiency experiment by Griffith and Wade (1935) on weanling rats the important symptoms were hemorrhagic degeneration of the kidney, fatty liver, and atherosclerosis. In the acute form of the choline-deficiency experiments, which the authors made on rats, renal damage occurred, and in seven cases intraocular hemorrhage was found. The choline quantities of the liver and kidney decreased very much. It is believed that the intraocular hemorrhage originated from the vessels in the region of the ciliary body and spread into the posterior chamber to form the vitreous hemorrhage. In cases of vitreous hemorrhage, exudative hemorrhage from a retinal vein was observed. It is shown also that hemorrhage and swelling occurred in the arterial wall, where mucoid degeneration and proliferation of endothelial cells were also noted. No intraocular hemorrhage was seen in the chronic form of choline deficiency but a dilatation of the vessels and swelling of the ciliary processes and an engorgement of the vessels of the retina is usually found. Furthermore, sclerosis of the media of the aorta can be seen. Choline is obviously one important factor in the development of atherosclerosis. (17 figures, 2 tables, 10 references)
Authors' summary.

Irinoda, K. and Ichinohe, M. **Experimental studies on ocular manifestations of biotin deficiency.** Jap. J. Ophth. **5**:31-41, Jan.-March, 1961.

The ocular manifestations in albino rats and the Long-Evans strain of hooded rats under the conditions of chronic and acute biotin deficiency were investigated. The external signs, such as loss of hair and squamous dermatitis of the general body appeared after about 20 days in the acute biotin deficient; and then dermatitis, alopecia of the face, head, back and hip were observed after more than 180 days in the chronic biotin deficient.

Ocular manifestations were as follows: in two experiments blepharoconjunctivitis; in most of the animals of two experiments blepharodermatitis (so-called spectacled eye), blepharoconjunctivitis and blepharitis marginalis; superfiicial dermatitis and corneal opacity with corneal vascularization were seen. There was corneal ulcer in a few animals.

Histological examination revealed desquamation, thinness, atrophy and degeneration of the epidermis of the lid skin, atrophy and degeneration of the hair matrix, hair follicle and Meibomian gland, little cellular infiltration in the corium. In a few animals proliferation of the epidermis was observed. In the internal organs stasis and congestion of the liver, spleen and lung were seen. The measurement of biotin according to Wright-

Skegg's method showed a low rate in the skin, blood, liver and kidney, and a marked decrease in the urine. (17 figures, 1 table, 11 references) Authors' summary.

Küchle, H. J. and Hartmann, R. **The value of the fluorescein test of Amsler and Huber in judging the activity of substances which inhibit inflammation and reduce vascular permeability.** Ophthalmologica **141**:100-121, Feb., 1961.

The fluorescein-appearance time as a measure of permeability of the blood-aqueous barrier has been subject to many criticisms, especially when used for quantitative measurements. The authors, however, defend the reliability of the method for comparative and qualitative studies. As an example, they devise a method for testing the inflammation-inhibiting and vascular-permeability-reducing effects of certain drugs, using this procedure.

A standard inflammation is produced by injecting foreign serum into one eye of a rabbit. Increased permeability is reflected by a more rapid appearance and higher concentration of fluorescein in the aqueous humor. The normal range of change is plotted, the opposite eye serving as a control. The administration of several test drugs inhibits the serum-induced increased permeability in varying degrees: hydrocortisone inhibits it completely; hesperidan phosphate does so markedly but less than hydrocortisone; heparin inhibits moderately but transiently; calcium gluconate and vitamins C, K, and P do so moderately (with no additive effects in combination); and adrenoxyl (the monosemicarbazone of adrenochrome) does not inhibit at all. (9 figures, 1 table, 42 references)

Lawrence T. Post.

Schaeffer, E. M., You, K. S., Bounds, G. W. and Heyssel, R. M. **Fibrinolysis in the anterior chamber of the rabbit eye.** A.M.A. Arch. Ophth. **65**:699-702, May, 1961.

A method for producing hyphema and measuring its rate of absorption by means of radioactivity is described. (4 figures, 2 tables, 9 references)

Edward U. Murphy.

Schultze, B., Apponi, G. and Nover, A. **Autoradiographic studies with $H_3$-thymidine on the neogenesis of desoxyribonucleic acid in ocular tissues of the rat.** Arch. f. Ophth. **163**:130-138, 1961.

DNA molecules of cells are marked with $H_3$ prior to mitosis. These were found in conjunctival and corneal epithelium, occasionally also in the choroid, ciliary body and iris. Corneal stroma and endothelium, sclera and retina contained no marked cells. (3 figures, 1 table, 25 references) Harri H. Markiewitz.

Simidu, S., Sakai, M., Koike, T., Funasaka, K. and Yoshiko, I. **Experimental melanin formation in living bodies. I. Influences of endocrine and sexual glands and their hormones.** Jap. J. Ophth. **5**:49-54, Jan.-March, 1961.

Several substances were extracted from so-called melanin, and the chemical structure in two of them is explained chemically and physically. The influences of endocrine and sex glands and their hormones upon the deposition of the substances in the iris tissue of mature albino rabbits was studied. It was found that the substances were not only a foreign body but also more similar to melanin itself, and that the degree of deposition of the substances in which Mc-1 and Mc-2 were important factors for the deposition, varied with the influence of the endocrine and sex glands and their hormones. The deposition was observed by electron microscopy as small black particles in the iris cell. (24 figures, 11 references)

Authors' conclusion.

Testa, M. **Transaminase activity of the corneal epithelium of the ox.** Boll. d'ocul. **39**: 379-384, 1960.

The author studied the corneal epithelium of the ox for evidence of transaminase activity, and found a significant degree of both glutammic-oxalacetic and glutammic-pyruvic transaminase activity. (1 table, 21 references) Joseph E. Alfano.

Trichtel, F., Papapanos, G. and Papapanu. R. **Experimental studies on rabbits concerning the retention in the anterior chamber of locally and parenterally administered hydrocortisone.** Arch. f. Ophth. **163**:139-144, 1961.

Highest concentrations were achieved by iontophoresis, lower ones by subconjunctival, topical or intravenous injections in this order; and were attained within two hours. Elimination of the drug was completed after six to 12 hours. (1 figure, 4 tables, 6 references)
Harri H. Markiewitz.

Trichtel, F. **Histologic studies of experimental iontophoretic damages to the rabbit's eye.** Arch. f. Ophth. **163**:145-158, 1961.

The high efficiency of iontophoretic administration of drugs must be weighed against the known harm done by electric currents. No changes occurred at levels below 3 mA, but corneal and lenticular damage was seen with stronger currents. (7 figures, 5 tables, 11 references)
Harri H. Markiewitz.

Yoshida, Eiichi. **Electron microscope studies of the pigment epithelium. Report I. Effects of sodium iodate poisoning.** Jap. J. Ophth. **5**:13-20, Jan.-March, 1961.

The eyes of rabbits were used and the effects of injection of sodium iodate were observed with the electron microscope. (5 figures, 10 references) F. H. Haessler.

## 4

## PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Bridges, C. D. B. **Dark adaptation following exposure to high-luminance flashes.** Brit. J. Ophth. **45**:44-53, Jan., 1961.

In order to support the described idea that peripheral dark adaptation depended on the quantity of light entering the eye rather than on the actual luminance of the flash, a rather elaborate apparatus was designed for measuring exposure of dark-adapted eyes to flashes of luminance greater than 10 to 6 ft. L. The apparatus is described in detail. It was found that the course of dark adaptation did depend on the quantity of light entering the eye and not on its brilliance. It was suggested that measurement of high intensities of light might be dangerous to the retina since the light absorbed into the pigment epithelium is degraded into actual heat and might well result in thermal burns of the retina. (6 figures, 9 references).
Morris Kaplan.

Frey, R. G. **Chromosomal anomalies and the heredity of congenital disturbances of color perception.** Arch. f. Ophth. **163**:117-129, 1961.

A review of recent discoveries in chromosomal patterns is followed by a description of a case of Turner syndrome with deuteranopia. Considering the sex-linked heredity of deuteranopia it is concluded that this patient's Turner syndrome was due to faulty oogenesis resulting in an OX-constitution. (6 figures, 35 references) Harri H. Markiewitz.

Grützner, P. **Typical acquired disturbances of color perception in heredodegenerative macular disease.** Arch. f. Ophth. **163**:99-116, 1961.

The maximal luminous sensitivity of

the 19 patients with hereditary macular degeneration had shifted toward the short-wave end of the spectrum. The disturbances are often independent of objective fundus changes or visual acuity and also affect perimacular areas. (5 figures, 30 references)

Harri H. Markiewitz.

Markiewitz, H. H. **On stereoscopic luster.** Arch. f. Ophth. **163**:188, 1961.

Complementary to recent studies by R. Sachsenweger, Helmholtz's little-known view of the subject is quoted. (1 reference)

Harri H. Markiewitz.

Perdriel, G., Guyard, M. and Raymand, G. **Corneal contact lenses and high altitudes.** Bull. et mem. Soc. franç. d'opht. **72**:286-293, 1959.

Corneal contact lenses seem to be ideal for the correction of ametropic flyers. However, research work on corneal contact lenses in high altitudes revealed that micro-bubbles of air appeared behind the lenses and accumulated especially over the corneal center. When examined with the cobalt light and slitlamp they were often seen in the superior temporal quadrant, the favorite place of a decentered lens. The air bubbles cause lesions of the epithelium, irritation, and photophobia. Methulose instead of saline solution behind the contact lenses prolonged the clearness of the fluid. Future research work will show the particular values of corneal lenses in various aeronautic problems, as in acceleration, deceleration, compression, and decompression in divers altitudes and also the possibilities of needed corneal protection. (4 references)

Alice R. Deutsch.

Rodger, F. C., Grover, A. D. and Fazal, A. **Experimental hemeralopia uncomplicated by xerophthalmia in Macacus rhesus.** Brit. J. Ophth. **45**:96-108, Feb., 1961.

Three monkeys placed on a vitamin A deficient diet were shown to have developed hemeralopia. This was measured by a specially designed adaptometer. Fluorescent microscopy revealed an absence of vitamin A in the liver; vitamin A blood levels were almost zero. (6 figures, 2 tables, 15 references)

Irwin E. Gaynon.

## 5

## DIAGNOSIS AND THERAPY

Allen, L. and Burian, H. M. **The trabeculotome: an instrument for trabeculotomy ab externo.** Tr. Am. Acad. Ophth. **65**:200-201, March-April, 1961.

Right and left paired, sharp and blunt, trabeculotomes are described. They act as spatulas to sever the trabecular meshwork. (1 figure, 2 references)

Harry Horwich.

Binder, R. F., Binder, H. F. and Skelly, J. R. **Fibrinolysis in the human eye.** A.M.A. Arch. Ophth. **65**:648-651, May, 1961.

Subconjunctival injections of human fibrinolysin (Actase) were used in patients with uveitis, hyphema, and vitreous opacities. Fibrin of recent formation could be resolved in active anterior uveitis. Hyphemas and vitreous hemorrhages were less responsive. (1 table, 32 references)

Edward U. Murphy.

Caramazza, R. and Frasca, G. **Electrographic recording of the pressure values of the ophthalmic artery.** Riv. oto-neuro-oftal. **36**:14-27, Jan.-Feb., 1961.

In an attempt to overcome the deficiencies of ophthalmodynamometry the authors evaluate an oscillographic method in determining the diastolic and systolic pressure in the ophthalmic artery. The results obtained with the Hager apparatus in 20 normal patients are analyzed. (2 figures, 5 tables, 46 references)

Wm. C. Caccamise.

Everett, W. G. and Sharrer, M. D. **A new-type silicone rod for scleral buckling.** Tr. Am. Acad. Ophth. **65**:197-199, March-April, 1961.

In order to avoid granulomata and drainage due to contamination of a polyethylene lumen, the authors use a solid silicone rod which is extruded with a 3-0 mersilene core or 3-0 braided stainless steel wire core. The suture is knotted, covered with silicone glue, and then a silicone sleeve is pushed over it for a watertight closure. Silicone rubber can be autoclaved. (1 figure, 3 references)

Harry Horwich.

Friedman, A. I. **New uses for old lenses.** Brit. J. Ophth. **45**:152-156, Feb., 1961.

The technique of using a small plano dental mirror as an aid in direct ophthalmoscopy of the periphery of the retina is given. The image is laterally inverted. The plane mirror is also useful in light coagulation of the retinal periphery, in indirect ophthalmoscopy and slitlamp ophthalmoscopy. (6 figures)

Irwin E. Gaynon.

Graham, P. A. and Stanworth, A. **A miniature ophthalmic diathermy machine.** Brit. J. Ophth. **45**:75-78, Jan., 1961.

The authors briefly describe a small ophthalmic diathermy apparatus which fulfills the requirements that the surgeon should be able to rely on the production of adequate coagulation without sparking or charring and that a minimum of adjustment is necessary. The instrument is small and portable and easily adjusted during surgery. (2 figures, 1 reference)

Morris Kaplan.

Korecz, K. **Experiences with Pyrophos, a new Russian miotic.** Szemészet **98**:18-21, 1961.

The author's examinations revealed the local and general toxicity of Pyrophos as being not highter than that of other miotics already tested, yet by the intensity and duration of its hypotonic effect the drug is applicable for conservative treatment of glaucoma. When combined with other miotics, its side-effects are reduced to a minimum. Owing to both its prolonged efficaciousness and relatively low-grade toxicity, the author considers Pyrophos suitable for out-patient treatment.

Gyula Lugossy.

Lytton, H. **The handle of the cataract knife.** Brit. J. Ophth. **45**:79, Jan., 1961.

Lytton briefly describes a change in the handle of the usual cataract knife which is broad and flat and gives more security and ease of handling. It further eliminates the easily made mistake of introducing the knife upside down into the anterior chamber. (1 figure) Morris Kaplan.

Medgyaszay, A. **Transitory change in refraction following administration of Fonurit (Diamox).** Szemészet **98**:13-17, 1961.

Twenty patients medicated with Fonurit (Diamox) were systematically and minutely checked. In one instance temporary change of refraction occurred and in another a disturbance of accommodation was found. The alteration was not observed by the patients themselves who had no visual complaints. The disorder was detected only in the course of routine examination. Gyula Lugossy.

Mitsui, Yukihiko and Takagi, Yoshihiro. **Nature of aqueous floaters due to sympathomimetic mydriatics.** A.M.A. Arch. Ophth. **65**:626-631, May, 1961.

Such floaters are not cells but seem to be pigment granules from the pigment epithelium of the iris. Contraction of the dilator muscle probably ruptures some epithelial cells and releases the pigment. (5 figures, 7 tables, 4 references)

Edward U. Murphy.

Paganoni, C. **Ocular manifestations of dystrophia myotonica.** Riv. oto-neuro-oftal. **36**:28-34, Jan.-Feb., 1961.

Dystrophia myotonica (Steinert's disease) is a hereditary familial disease which is characterized by myotonia, muscular atrophy, and by signs of dystrophy. The author describes the ocular findings in 21 patients with this disease who were examined by him. He also reviews the literature pertaining to this type of dystrophy. The ocular manifestations are the well-known cataracta myotonica, hypotony, ptosis, enophthalmos, and less frequently, lagophthalmos and blepharoconjunctivitis. Fundus lesions have not been observed as manifestations of dystrophia myotonica. (2 tables, 27 references)

William C. Caccamise.

Reinecke, R. D. **Facial paralysis—an aid for animal ophthalmoscopy.** A.M.A. Arch. Ophth. **65**:591, April, 1961.

Ophthalmoscopic examination of experimental animals is difficult because of blepharospasm and covering of the eye by the nictitating membrane. In the cat, a 1 cm. excision of the orbicularis branch of the seventh cranial nerve is simply done and for several months allows easy examination of the fundus without general anesthesia. (2 figures)

Edward U. Murphy.

Smyelovskii, A. S. **A new method of prevention of expulsive hemorrhage.** Vestnik Oftal. **2**:21-24, March-April, 1961.

To prevent expulsive hemorrhage the author suggests obliteration of both posterior ciliary arteries by transcleral diathermy coagulation. It is recommended that this operation be performed from two to three months prior to a cataract operation and from 10 to 12 days before a glaucoma operation. The operation was performed on 41 eyes with senile cataract and 19 eyes with glaucoma. No serious complications were observed.

This operation is recommended for patients who have cataract and glaucoma, cataract accompanied by hypertensive or atherosclerotic diseases, for those who are over 70 years old, and for those who have senile cataracts in their only eye. (22 references)

Benjamin Ziv.

Vassura, G. W. and Rebucci, G. G. **Ophthalmoscopic, neuroradiologic and electroencephalographic findings in a case of tuberous sclerosis.** Riv. oto-neuro-oftal. **36**:35-52, Jan.-Feb., 1961.

The authors report their findings in a 21-year-old girl who was admitted to their clinic with a diagnosis of "convulsive syndrome." Although the patient presented facial skin lesions, they resembled those of acne rather than those of adenoma sebaceum. The patient refused permission for biopsy of one of the facial nodules. Neurological examination was essentially negative. Ophthalmoscopic examination revealed a papillomatous mass extending from the superior half of the disc into the vitreous of the left eye. Ophthalmoscopic examination of the right eye revealed two small papillomatous formations in the inferior temporal periphery. Electroencephalographic tracings revealed abnormalities. Neuroradiologic studies revealed areas of calcification in the region of the basal ganglia and the cerebellum. Pneumoencephalographic studies revealed a calcific protrusion into the ventrical in the region of the frontal horn. The authors then go on to review the literature and to interpret the findings in their own case. (7 figures, 29 references)

Wm. C. Caccamise.

Wertheimer, P., Rougier, I., Wertheimer, J. and Lapras, C. **Semeiologic evaluation of Parinaud's syndrome in intracranial tumors.** Bull. et mem. Soc. franç. d'opht. **72**:197-207, 1959.

Parinaud's syndrome has been observed only infrequently. Nevertheless it is of

great localizing significance. Among 2,000 patients treated at the Neurological Center of Lyon only 16 applicable case histories could be found. The list of lesions included two pineolomas, verified histologically. Five others were considered to belong to the same group, on the basis of clinical manifestations and radiologic findings. One oligodendroglioma and two ependymomas were diagnosed pathologically. In six cases the exact diagnosis could not be made; these lesions nevertheless were classified as gliomas on the basis of the clinical findings, radiologic reports and age of the patients. The age of the patients with pineoloma generally was about 20 years, whereas carriers of glioma were usually over 30 years old. It would be very unusual to find this syndrome as an isolated or primary sign. It is generally accompanied by headaches, vomiting, papilledema, associated disturbances of ocular motility, and progressive hemiplegia. It is of very great localizing signifiance equal only to ventriculography. Arteriography contributed little; EEG revealed deep-seated lesions vaguely and only when they were located close to the midline. Anatomic and clinical data placed the lesions in the posterior subthalamic region at the junction of the third ventricle and the aqueduct of Sylvius. Alice R. Deutsch.

Ziv, Benjamin. **The gold ring electrode in electroretinography.** A.M.A. Arch. Ophth. **65**:582-583, April, 1961.

A new approach to electroretinography which eliminates some deficiencies of the contact lens electrodes is described. (2 figures, 1 reference)

Edward U. Murphy.

## 6

## OCULAR MOTILITY

Apt, L., Costenbader, F. D., Parks, M. M. and Albert, D. G. **Catgut allergy in eye muscle surgery. II. Correlation and comparison of eye reaction and skin test after the use of plain and chromicized catgut.** A.M.A. Arch. Ophth. **65**:747-480, April, 1961.

An immediate local hypersensitivity reaction to catgut sutures occurred in about one half of patients who had previous eye muscle surgery. Less than one third of those without prior surgery showed a reaction, but here it was delayed and appeared in about one week. The reaction in no way affected the expected results of surgery. Chromic catgut showed less frequent and less severe reactions than plain. (2 tables, 20 references)

Edward U. Murphy.

Cristini, G. **The site of sensory-motor disorders in concomitant squint.** Ophthalmologica **141**:1-16, Jan., 1961.

The site of the defect in patients exhibiting suppression and suppression amblyopia continues to excite the interest of many investigators. The present author discusses the subject at some length, reasoning freely without the presentation of new data. In the classical view visual perception is divided into two parts: the first, physiological, includes the function of all nervous elements from the retinal reception of light stimuli, through the transmission of these stimuli by the visual pathways to an eventual point-for-point representation on the occipital striate cortex; the second part, psychological, includes the conscious recognition of these stimuli, that is, the integration of the visual stimuli with those derived from other peripheral sensory stimuli. It is stated that, according to various theories, one or the other of these parts is usually considered at fault in suppression and amblyopia. Cristini finds either hypothesis difficult to accept, the physiological, because such quantitative tests as determination of light threshold show no defect, and the psychological, because unilaterality is hard to explain.

The author is struck by the apparently analogous symptomatology of certain lesions in the parietal lobe. One such phenomenon shown by patients with parietal disease is that of "cutaneous extinction"; although a tactile stimulus can be felt on the affected side of the body, if a similar stimulus is applied at the same time to the healthy side, the first will cease to be appreciated. This and other considerations lead him at length to the conclusion that "sensory-motor squint disorders may be considered . . . the consequence of defective spatial summation within . . . (the parietal) paravisual areas, where visual retinoceptions are integrated with extramuscular proprioceptions, so that these sensory stimuli received by this area find difficulty in exciting the interest in competition with stimuli received by the other intact area."

The article is replete with terms unfamiliar to this reader and references to work of which prior knowledge is assumed; this combined with the sesquipedalian English makes for pretty rough going. (49 references) Lawrence T. Post.

Dal Fiume, E. and Navarra, R. **The effect of inhalation of cerium salts on the suppression phenomena of strabismus.** Boll. d'ocul. **39**:490-501, 1960.

The authors found improvement in the suppression phenomena associated with convergent strabismus in 80 percent of 51 patients treated by means of the inhalation of cerium salts. (10 references) Joseph E. Alfano.

Mackensen, G., Kommerell, G. and Silbereisen, D. **Investigations of the physiology of the optokinetic after-nystagmus. II.** Arch. f. Ophth. **163**:170-187, 1961.

In general, the following may be concluded: the optokinetic after-nystagmus is a physiologic act which follows optokinetic stimulation. It begins immediately, or after a latent period, with a deviation in the direction of the slow phase. It first assumes the same direction as the initial horizontal optokinetic nystagmus but may then become reversed. The amplitude and frequency decline irregularly with the duration and it usually ends with nondirectional jerks. The duration of the optokinetic after-nystagmus is independent of the duration of the stimulus and may even exceed this. Its duration, regularity, frequency and amplitude are individually characteristic. It is inhibited by fatigue and lid closure. The diagnostic significance cannot yet be established; a difference in distinction between left and right nystagmus also occurs in normal subjects. (12 figures, 6 tables, 9 references) Harri H. Markiewitz.

Reinecke, R. D. **Special review. Review of optokinetic nystagmus from 1954-1960.** A.M.A. Arch. Ophth. **65**:609-615, April, 1961.

The results of the application of electronic instrumentation, especially electrooculography, are discussed. (78 references) Edward U. Murphy.

## 7

## CONJUNCTIVA, CORNEA, SCLERA

Alberth, B. **Doubling of the Descemet membrane after perforating keratoplasty in man.** Szemészet **98**:21-23, 1961.

The author reports his histologic investigations on a corneal disc having turned gray. He found in the graft a whole Descemet new-formation corresponding in size to the transplanted part which is proved by its intense proliferation. Gyula Lugossy.

Bito, L. Z. and Harding C. V. **Tritium retention by corneal endothelium after incorporation of $H_3$-thymidine.** A.M.A. Arch. Ophth. **65**:553-556, April, 1961.

This work suggests the use of this substance for following the fate of endothe-

lium in corneal transplants. Endothelial cells retain tritium as long as five months after its injection. (5 figures, 11 references) Edward U. Murphy.

Bucci, M. G. **A case of juvenile polymorphic dystrophy of the corneal endothelium.** Boll. d'ocul. **39**:383-394, 1960.

The author presents a brief review of endothelial dystrophy of the cornea, and then presents the case of a 38-year-old white male with a bilateral polymorphous, juvenile endothelial dystrophy with secondary corneal edema and bullus-formation. (2 figures, 29 references)

Joseph E. Alfano.

Burns, R. P. and Rhodes, D. H. **Pseudomonas eye infection as a cause of death in premature infants.** A.M.A. Arch. Ophth. **65**:517-525, April, 1961.

A common inhabitant of hospital nurseries is the Pseudomonas bacillus. The authors review nine cases, four of them fatal, of systemic infection with this pathogen. The ocular structures were apparently the site of entrance and conjunctivitis rapidly progressed into corneal abscess, panophthalmitis, orbital cellulitis, and septicemia. (5 figures, 28 references)

Edward U. Murphy.

Carenini, B. B. **Juvenile familial mosaic degeneration of the cornea associated with megalocornea.** Brit. J. Ophth. **45**:64-70, Jan., 1961.

The degeneration of Bowman's membrane known as juvenile mosaic degeneration is sufficiently rare to merit description of the disease found in the middle three of five brothers in whose family no other evidence of ocular disease could be found. All three were in their sixties and all began to develop some diminution of vision in their middle years. All had some degree of megalocornea but all also had fair to good vision despite the "crocodile skin" appearance of Bowman's membrane. The disease may be of the senile type in which there is great loss of vision or the juvenile type in which the lesions appear around the thirtieth year and fair to good vision is maintained. Nine other cases have been reported in the literature.

Morris Kaplan.

Fechner, P. U. **Influence of corticotropin (ACTH) on healing of corneal ulcers in guinea pigs.** A.M.A. Arch. Ophth. **65**:557-562, April, 1961.

The results of a previous study using intraperitoneal pyrogen were compared with the present one. Corticotropin suppressed healing while pyrogen accelerated it. Fever therapy should not be entirely abandoned in favor of steroid treatment because this and other studies indicate that there are other beneficial effects of fever therapy besides the discharge of corticosteroid hormones. (1 figure, 3 tables, 28 references)

Edward U. Murphy.

Fiedler, H. W. and Costin, R. L. **Carcinoma of the conjunctiva after enucleation.** A.M.A. Arch. Ophth. **65**:669-671. May, 1961.

A case of epidermoid carcinoma of the conjunctiva appearing nine years after enucleation of the eye for trauma is reported. (4 figures, 3 references)

Edward U. Murphy.

Grover, A. D. **Penicillin-streptomycin-gelatine discs in the treatment of hypopyon ulcers.** Brit. J. Ophth. **45**:27-36, Jan., 1961.

Penicillin is active against the Gram-positive organisms and streptomycin is active against the Gram-negative; the combination of these two has a wide range of activity and is useful in treatment of corneal ulcers. The passage of these drugs into the anterior chamber when given sys-

temically is unsatisfactory whereas subconjunctival injection can produce satisfactory results. When instilled they penetrate the intact cornea very slowly but do so rapidly through the broken epithelium as in an ulcer but the exposable time with ordinary drops is unsatisfactory.

In a series of hypopyon ulcers, these antibiotics were incorporated into gelatin discs and applied within the conjunctival sac; the results were compared to those in another series in which subconjunctival injections were used. The results in the patients using the more easily applied gelatine discs were just as good or even slightly better than those obtained by subconjunctival injection. (16 references)

Morris Kaplan.

Guerra, P., Maffei, S., Grayton, J. and Woolridge, R. L.: **The complement fixation test in Erythrean trachomatous patients.** Boll. d'ocul. **39**:475-483, 1960.

Using a specific purified antigen from the serum of patients with known trachoma, the authors performed a complement fixation test on the serum of 43 patients with known active trachoma. Eighty-one percent of these patients gave a positive complement fixation in titers ranging from 1:4 to 1:64. The possibility of using a complement fixation test for the diagnosis of trachoma is suggested. (3 tables, 14 references)

Joseph E. Alfano.

Krwawicz, T. **New plastic operation for correcting the refractive error of aphakic eyes by changing the corneal curvature. Preliminary report.** Brit. J. Ophth. **45**: 59-63, Jan., 1961.

Despite the work done by Ridley, there remains considerable work to be done to alleviate the great refractive error following cataract extraction. After 52 experiments on rabbit eyes in which the refractive power of the cornea was changed by surgery, the procedure was done on eight human eyes, six prior to cataract extraction and two thereafter. A small plastic disc was introduced in mid-stroma in the corneal center; after 10 to 12 days of healing, the disc was easily removed and the corneal changes remained permanent. The increased refractive power of the cornea was appreciable in correcting the aphakic error and no complications of the procedure were noted. The results were sufficiently encouraging to merit further studies. (10 figures, 1 reference)

Morris Kaplan.

Martins, M. and Fatorelli, A. **Recent advances in corneal surgery.** Rev. brasil. oftal. **20**:75-98, March, 1961.

The authors mention briefly the posterior keratectomies, described by Paufique, and the corneal incisions made by Sato for the correction of myopia and astigmatism. The greatest part of their paper is dedicated to keratoplasties, penetrating as well as lamellar. The immunoallergic reactions between donor and recipient corneas are studied. The final portion of the paper deals with the storage of corneas. (30 references)

Walter Mayer.

Molnár, L., Herpay, Z. and Gát, G. **Mycosis conjunctivae caused by Cephalosporium niveolanosum (Benedek).** Szemészet **98**:32-37, 1961.

The authors report on a case of primary mycosis conjunctivae caused by Cephalosporium niveolanosum. In cases of antibiotic allergy and of bacterial infections which do not heal with antibiotic therapy, as well as in cases with negative culture results, one must also think, among other things, of the possibility of mycotic infection.

Gyula Lugossy.

Nelken, E., Nelken, D., Michaelson, I. C. and Gurevitch, J. **Late clouding of experimental corneal grafts.** A.M.A. Arch. Ophth. **65**:584-590, April, 1961.

Work on rabbits shows that late clouding can be caused by blood group incompatibility where the isoantibody titer of the recipient is high. This occurs with titers of 1:64 or higher. The disease of the graft could be prevented in such cases by choosing compatible donor material. (5 figures, 20 references)

Edward U. Murphy.

Palich-Szanto, O. **Contributions to the symptomatology, etiology and therapy of allergic external eye diseases.** Arch. f. Ophth. **163**:159-169, 1961.

Some allergic affections of the lids, conjunctiva, cornea and sclera, as seen in Budapest, are reported. Therapy consisted mainly in topical and systemic administration of antihistaminic drugs. (3 tables, 17 references) Harri H. Markiewitz.

Rizzini, V. **Herpetic marginal ulcer of the cornea.** Boll. d'ocul. **39**:328-332, 1960.

The author presents the case of a 62-year-old white man who had had a history of repeated attacks of dendritic ulcer in his right eye. He now presented himself with a complete annular ulceration just within the limbus in the opposite eye. The author felt that this annular ulcer was dendritic in nature and it was therefore treated with iodine cauterization and supportive therapy. The final result was satisfactory. (1 figure, 9 references)

Joseph E. Alfano.

Stocker, F. W., Matton-VanLeuven, M. T., Eiring, A., Georgiade, R. and Georgiade, N. **In vitro procedure for determining transparency of fresh and preserved donor corneas.** A.M.A. Arch. Ophth. **65**:703-707, May, 1961.

A new method is presented in which an electronic photometer is used. Results with rabbit corneas are reported. (2 figures, 2 tables, 3 references)

Edward U. Murphy.

Straub, M. W. **Pathologic changes of the human eye after exposure to hydroquinone.** Bull. et mem. Soc. franç. d'opht. **72**:231-235, 1959.

Pathologic changes of the eyes caused by hydroquinone are very rare. Nevertheless 13 persons, working in the only hydroquinone factory in Germany, were found to have specific changes in the conjunctiva and cornea. Brownish incrustations were found in the interpalpebral part of the conjunctiva and extended to the limbus. Histologic sections revealed deposits in the subepithelial layer and in the basal layers of the epithelium. There were no collateral inflammatory reactions. Corneal involvement, which was seen in three cases, also consisted of brownish opacities in the lid fissure, occupying the whole thickness of the cornea, especially the deep layers. Folds of Descemet's membrane were occasionally visible. There is no specific treatment; hydroquinone makes an insoluble compound with the tissue proteins after penetration of minute particles. This is the reason why the severe corneal changes did not subside, but even progressed after the afflicted persons changed employment. (1 figure, 10 references)

Alice R. Deutsch.

Veirs, E. R. **Evisceration. A procedure for reinforcing the cornea.** A.M.A. Arch. Ophth. **65**:621-625, May, 1961.

The weakest segment of an eviscerated eye is the cornea and the implant is occasionally extruded through this area. (6 figures, 4 references)

Edward U. Murphy.

## 8

### UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bucci, M. G. **The Reuma-test in the etiologic investigation of uveitis.** Boll. d'ocul. **39**:501-526, 1960.

The author performed the Reuma (la-

tex-fixation) test for the presence of rheumatoid factors in 150 cases of uveitis. The test was positive in only nine of these patients, doubtfully positive in two and negative in the remainder. (3 tables, 33 references) Joseph E. Alfona.

Catterall, R. D. and Perkins, E. S. **Uveitis and urogenital disease in the male.** Brit. J. Ophth. **45**:109-116, Feb., 1961.

Uveal inflammation, chronic prostatitis, and joint changes constitute a triple syndrome. All three do not have to be present. The uveal tracts, joints, and the prostate have a common mesodermal origin. Acute anterior uveitis is not an isolated disease. It is closely linked with disorders of other mesodermal constituents in the body. (12 tables, 5 references)
Irwin E. Gaynon.

Korets, K. **Essential progressive atrophy of the iris after neck injury.** Vestnik Oftal. **1**:60-61, Jan.-Feb., 1961.

The author presents a case of iris atrophy provoked by the disturbed trophic function of the sympathetic nerve as a result of a neck injury. (12 references)
Benjamin Ziv.

Luntz, M. H. **Glaucoma treated with Daranide.** Brit. J. Ophth. **45**:125-129, Feb., 1961.

Daranide, a new carbonic anhydrase inhibitor is more potent than Diamox and is used in smaller dosage. The side effects of Daranide consisted of paresthesias, skin rash, depression, loss of appetite, indigestion, drowsiness, and headache. The side effects were much more frequent and more severe than with Diamox, and it was not any more effective in controlling ocular tension. (2 figures, 8 references)
Irwin E. Gaynon.

Remky, M. H. **Acquired toxoplasmic uveitis. New serological and clinical aspects.** Bull. et mem. Soc. franç. d'opht. **72**: 273-286, 1959.

The detection of the etiology in a given case of uveitis has been and still is a great and disquieting problem. Unquestionably there are more cases of toxoplasmic uveitis than are generally diagnosed. The absence of simple diagnostic tests makes the diagnosis of acquired toxoplasmosis especially difficult as are also the differential diagnosis from congenital toxoplasmosis and recurrence. The author discusses the significance of the dye test and the complement fixation test and he adds a third test which is based on the antibody content of the aqueous. It cannot be denied that an increased antibody content of the aqueous as compared with the serum favors the diagnosis of toxoplasmic uveitis. This test is not easy to evaluate, especially if the protein content of the aqueous is low, as it often is in posterior uveitis. It also proves to be unreliable if the titer of the dye test in the serum is lower than 1/512. The case histories of 24 patients with uveitis are reviewed. Six patients had recurrent attacks of choroiditis, a proof that recurrences are not specific for congenital toxoplasmosis. Six other patients showed diverse manifestations of toxoplasmosis such as lymphadenitis and encephalitis. Twenty patients had the disease with its polymorphous forms in one eye only. Seeding in the immediate neighborhood of an apparently healed lesion is considered to be the typical fundus picture. It is also essential to distinguish an active case from a quiet, symptomless manifestation of toxoplasmosis. (5 figures, 5 references) Alice R. Deutsch.

## 9

## GLAUCOMA AND OCULAR TENSION

Akourena, G. Z. **The dynamics of dark adaptation in glaucoma patients.** Vestnik Oftal. **1**:25-27, Jan.-Feb., 1961.

In glaucomatous patients there is a definite disturbance of the dark adapta-

tion curve which is directly dependent on the state of intraocular pressure. Novocain, dibasol, and oxygen increase the dark adaptation curve, especially in patients with advanced glaucoma. These drugs may be recommended to the patients as part of complex therapy. Normalization of intraocular pressure after an operation does not always increase the adaptation curve. (12 references)

Benjamin Ziv.

Calixto, N. **Applanation versus impression tonometry.** Rev. brasil. oftal. **20**:49-72, March, 1961.

The author studies applanation versus impression tonometry in its relationship to the normal physiologic variation of intraocular pressure in young men. He reviews the history and theory of the two methods of tonometry and emphasizes the significance of the scleral rigidity factor in the errors obtained with impression tonometry. Optimal results can best be obtained by combining applanation tonometry and Schiøtz tonometry. (4 figures, 8 tables, 16 references)

Walter Mayer.

Carenini, B. Boles. **Research into the problem of the preference of primary glaucoma for the left eye and on the structural and functional differences of the outflow pathways in both eyes.** Boll. d'ocul. **39**:332-352, 1960.

The author attempted to determine whether in primary glaucoma the left eye was preferentially affected. Toward this end he reviewed cases in which glaucoma had affected a total of 2,349 eyes. From this survey he concluded that in patients with bilateral glaucoma, the left eye is usually involved earlier than the right eye and in patients with unilateral or absolute glaucoma, the eyes are simultaneously involved.

He performed tonographic studies on 122 patients with normal eyes and water provocative tests on 50 patients with normal eyes, to see if he could find why the left eye appeared preferentially involved. He found the coefficient of facility of outflow (although in the range of normal) to be somewhat lower in the left eye than in the right eye. He also found the rise in the intraocular pressure to be higher in the left eye than in the right eye during the water provocative test. He found no significant difference between the axial depth of the anterior chambers of the two eyes of these subjects, and no significant gonioscopic differences in the chamber angles. He felt that these differences in normal eyes, and the predilection for glaucoma in the left eye were due to differences in pressure in the episcleral veins resulting from the anatomic differences in the innominate veins. (5 figures, 12 tables, 16 references)

Joseph E. Alfano.

Davis, M. D., Duehr, P. A. and Javid, M. **The clinical use of urea for reduction of intraocular pressure.** A.M.A. Arch. Ophth. **65**:526-531, April, 1961.

This drug is particularly useful in acute angle-closure glaucoma and in all 10 cases reported there was immediate relief of increased pressure where other measures had failed. Other uses mentioned were in scleral buckling procedures and orbital surgery. (6 figures, 11 references)

Edward U. Murphy.

Dyereyeva, G. M. **The d'Arsonval approach as a therapy in glaucoma outpatients.** Vestnik Oftal. **1**:23-24, Jan.-Feb., 1961.

In 1956 Shatelova and Nekoulena applied d'arsonvalization to 77 glaucomatous eyes of hospitalized patients with the following results: in 37, there was an improvement in vision and an increase in the visual field; the blind spot decreased in 43 out of 60 eyes.

They also applied local d'arsonvalization to 143 glaucomatous eyes in outpa-

tients who were diagnosed as having primary, developed, and advanced forms of glaucoma. In addition these patients were given miotics. The visual acuity increased in 61.5 percent, the visual field was enlarged in 75.5 percent, and the blind spot diminished in 87.5 percent. Because the effect of d'arsonvalization is of short duration, lasting only two to three months, the repetition of this treatment is recommended. (5 references) Benjamin Ziv.

Goncalves, F. P. **Medical treatment of chronic simple glaucoma.** Arq. brasil. oftal. **23**:155-180, 1960.

In this long article the author discusses the various means of treating chronic simple glaucoma by means of local, oral, and parenterally administered drugs, hormones, dietary measures, and forms of physical therapy. In general, the aqueous outflow should be facilitated by miotics. Decreased formation of aqueous may be advisable through the use of carbonic anhydrase inhibitors or the local instillation of sympathomimetic amines. Some additional benefit may be obtained from the use of sedatives, tranquilizers, and dietary and hygienic measures.

James W. Brennan.

Hill, K., Whitney, J. B. and Trotter, R. R. **Intravenous hypertonic urea in the management of acute angle-closure glaucoma.** A.M.A. Arch. Ophth. **65**:497-503, April, 1961.

This substance rapidly lowered intraocular pressure in 10 of 13 patients who failed to respond to miotics and Diamox. Side effects were usually mild. (2 tables, 2 figures, 14 references)

Edward U. Murphy.

Huber, A. **Glaucoma as a complication of heterochromic iritis of Fuchs.** Ophthalmologica **141**:122-135, Feb., 1961.

This paper represents a clinical study of glaucoma secondary to heterochromic iridocyclitis. No individual case studies are presented, but as a background for a general discussion the author has drawn on 23 of his own cases and 26 contributed by three other ophthalmologists.

Heterochromic iridocyclitis is a benign disease unless a secondary glaucoma develops. Even if a secondary cataract develops, its removal is usually without complication. The diagnosis of heterochromic iridocyclitis is made by the presence of 1. heterochromia (unhelpful, of course, in bilateral cases), 2. iris atrophy which may be: a. hyaline degeneration of the pupillary ruff with the formation of a translucent membrane which frequently contains gray nodules, and b. the appearance of mid-stromal lacunae, primarily in the posterior pigment layers which are seen best by retroillumination, 3. keratic precipitates which are gray-white, transparent, granular, and are frequently connected by fine fibrin filaments, 4. anterior vitreous haze, 5. complicated cataracts, 6. vascularization of the angle by radial or looping vessels running from the ciliary body to the trabecula which is said to be the most important diagnostic clue, although two previous authors found this in only one-third of their patients.

Secondary glaucoma can be expected in about 25 percent of these cases, perhaps more frequently in bilateral cases. The angle, except for the vessels (which may or may not be present) looks normal; it is wide, there are no peripheral anterior synechiae, and there is no pigmentation. In two cases the pathologic specimen revealed an odd hyalinization of the trabecula. There is increased resistance to aqueous outflow. A peculiarity of the disease is the not infrequent abrupt rise in pressure following a diagnostic anterior chamber puncture. The therapy, which is discussed in some detail, does not differ from that for ordinary open-angle glaucoma. Lawrence T. Post.

Kobzyeva, V. E. **Diathermocoagulation of the sclera in glaucoma.** Vestnik Oftal. 1:21-23, Jan.-Feb., 1961.

The new antiglaucoma operation, the diathermycoagulation of the sclera of the ciliary region, suggested first by V. N. Archangelskii in 1957, was performed on 45 eyes of 43 glaucoma patients, who were divided into two groups and observed over a period of two years. The operation was performed on patients in whom miotic drops had no effect in lowering the eye tension.

The following results were obtained: in the first group normalization of eye pressure occurred in 17 out of 25 eyes, vision was improved in five patients, in 18 there were no changes, and in two the vision became worse. The visual field improved in five patients and in 20 it remained unchanged. In the second group of patients who had primary glaucoma, normalization of pressure occurred in 18 out of 19 patients.

The significance of this operation lies in the fact that it affects only those functions which are related to eye pressure and does not disturb any other normal visual function. However, the following after-effects may result from this operation: iridocyclitis with exudates, synechias with pigment, and choroidal detachment. (11 references) Benjamin Ziv.

Kronfeld, P. C., Ballintine, E. J., Moses, R. A., Grant, W. M., Becker, B. and Roberts, R. W. **Symposium: Tonography.** Tr. Am. Acad. Ophth. 65:133-170, March-April, 1961.

Kronfeld, P. C. **The principle of tonography: terms and definitions.** pp. 133-135.

The work of Grant and Friedenwald is briefly reviewed, specifically Grant's formula for C (coefficient of the facility of aqueous outflow) and Friedenwald's calibration and rigidity studies. To resolve differences of opinion on the validity of conclusions derived from tonography, a panel was formed. Their opinions follow in the symposium. Terms clarified are the intraocular pressure during tonometry, the starting point in tonography, the change in intraocular fluid contents during tonography, the coefficient of ocular rigidity, the average pressure, and the rate of aqueous flow. (10 references)

Ballintine, E. J. **Tonographic technique.** pp. 136-144.

Automatic recording is essential. Three types of machine are evaluated. A simple technique for doing tonograms and determining C is described. The 7.5 gram weight should be used for tonography if the preliminary applanation reading is greater than 22. The average value for C is 0.28. (12 figures, 3 tables)

Moses, R. A. **Errors in tonography.** pp. 145-151.

A steady state is essential. This can be disrupted by the use of pilocarpine or a darkened room. Large errors can be made in estimating ocular rigidity, which can be very misleading. However, ocular rigidity can be eliminated as a factor in tonography. When the technician or patient is nervous, a steep initial drop may be found. Other causes of error are the sticking of an improperly cleaned tonometer, pressure on the globe, and tilting of the instrument. Coughing, breath-holding, lid squeezing and unsteady fixation also are causes of error. (10 figures)

Grant, W. M. **Experimental tonography.** pp. 152-155.

The theoretical pitfalls of assuming validity in tonography are enumerated. However, perfusion experiments show a surprising correlation between the conclusions drawn from tonography and those arrived at under controlled experimental conditions. The difference between the rise in pressure due to forward movement of the ciliary body and that occasioned by closure of the iris corneal angle is elucidated. Quantitative aqueous perfusion still

has the advantages of directness and accuracy. (18 references)

Becker, B. **Tonography in the diagnosis of simple (open angle) glaucoma.** pp. 156-162.

The chief practical value of tonography is in demonstrating glaucoma when tonometer readings suggest normality. Decreased ocular rigidity, as in myopia, thyrotropic exophthalmos, post-operative states, and after ingestion of water or instillation of strong miotics, may cause one to erroneously ignore glaucoma. Similarly, normal tonometry may occur if the patient is examined during his diurnal low point.

Less than 2.5 percent of normal people have $P_o/C$ greater than 100; that is, pressure greater than 21 and facility less than 0.18. Less than 0.15 percent have $P_o/C$ greater than 138; that is, pressure greater than 24, facility less than 0.13. Tonometry alone will reveal half of glaucoma cases, tonography reveals two thirds of them, the $P_o/C$ greater than 100 reveals 70 percent and the $P_o/C$ after 1 liter of water reveals 95 percent.

Because these findings are so dramatically elicited early where there is a family history of glaucoma, all such families should be investigated. Altered findings may anticipate clinical glaucoma by several years. (8 figures)

Roberts, R. W. **Tonography in the management of glaucoma.** pp. 163-170.

Visual fields are almost always retained when C is normalized, and lost when it is not. This is a much closer correlation than that between fields and pressure alone. For this study, a C value of .18 or more is considered normal. Even so, 10 percent of such eyes lost field. When pressure was usually over 21, 48 percent lost field. Maintenance of a $P_o/C$ value less than 100 gives even better control of field loss. Tonography has shown that epinephrine and acetazolamide lower pressure by reducing aqueous flow.

Although loss of visual field, rather than tonographic findings, indicates surgery, the latter can be an excellent measure of the success or failure of the procedure. Tonometry alone may be misleading, due to low scleral rigidity. In narrow-angle glaucoma, tonography can help the surgeon decide whether a filtering procedure is needed or a peripheral iridectomy will suffice. (9 figures)

Harry Horwich.

Kupfer, Carl. **Studies on intraocular pressure. I. A technique for polyethylene tube implantation into the anterior chamber of the rabbit.** A.M.A. Arch. Ophth. **65**:565-570, April, 1961.

This procedure allows the measurement of intraocular pressure in the unanesthetized animal over several weeks. (7 figures, 1 table, 2 references)

Edward U. Murphy.

Luder, P. **Pigmentary glaucoma.** Ophthalmologica **141**:136-154, Feb., 1961.

Eleven case histories are added to 28 already reported elsewhere in the literature to provide the basis for a general discussion of the disease picture, pathogenesis, and treatment. For purposes of description the signs and symptoms are divided into four groups. 1. The pathologic pigment conditions. A Krukenberg spindle is almost invariably present; in several cases a ring of pigment precipitates was also noted near Schwalbe's line. In addition, pigment is frequently scattered over the trabecula, ciliary body, iris surface, anterior lens capsule and zonules (the trabecular pigmentation tends to be uniform throughout the entire angle, whereas the pigmentation of age, diabetes, and myopia, in contrast, is much denser inferiorly and is not associated with other pigment changes. Loss of density in the posterior layers of the iris, best demonstrated by retroillumination (atrophy may occasionally be so great

as to result in iridodonesis); 2. Among the signs and symptoms of open-angle-type glaucoma the authors note a tendency to less rapid and less marked field loss and surmise that this might be ascribed to the younger age of these patients. 3. The refractive anomalies. Almost all patients are myopic (Krukenberg spindles with or without glaucoma occur almost exclusively in myopes). 4. General observations. Pigmentary glaucoma occurs more frequently in men than in women (3 : 1), and in younger individuals (25 of the 39 patients were under 45, only two over 60); most patients are of leptosome-asthenic body habitus and demonstrate vegetative lability. A vascular factor is suggested by two observations: three patients showed retinal vein occlusions, two bilaterally, and of the six patients operated upon, five developed hyphemas. Treatment is that of ordinary open-angle glaucoma.

The article concludes with a discussion of pathogenesis; the only definite conclusion arrived at is that the pigment on the trabecular surface is not alone responsible for the glaucoma, since the pigmentation of age, myopia, and diabetes is not associated with an elevated pressure. (3 figures, 1 table, 5 references)

Lawrence T. Post.

Macri, F. J. **Vascular pressure relationships and the intraocular pressure.** A.M.A. Arch. Ophth. **65**:571-574, April, 1961.

These relationships were studied in the eye of the cat. (3 figures, 1 table, 3 references) Edward U. Murphy.

Palagi, D., Jr. **Tonographic research on high myopic anisometrophy.** Boll. d'ocul. **39**:415-430, 1960.

Using ordinary tonometric methods, the author determined the coefficient of facility of outflow in 31 patients with a high degree of anisometropia, that is in subjects with one normal eye and one which is highly myopic. He uniformly found that in the highly myopic eye the coefficient of facility of outflow was consistently below that of the normal or emmetropic eye. However, he also found that although the coefficient of facility of outflow was reduced in the myopic eye, it did not fall below the accepted limit of normal. He concludes with the suggestion that the error of refraction should be considered in each tonographic curve. (2 tables, 2 grafs, 38 references)

Joseph E. Alfano.

Peret, P. **Adaptometry and glaucoma.** Rev. brasil. oftal. **20**:5-47, March, 1961.

The author reviews our present knowledge of night vision and describes the Goldman-Weekers adaptometer. Using Gordon's basic standard curve of dark adaptation, he presents the adaptometric curves of a normal individual and several curves of patients with disturbances of night vision. He studies in great detail the adaptometric curves of 61 glaucomatous eyes reaching the conclusion that 91.8 percent of these eyes had lower than normal adaptometric curves. He could find no correlation between the adaptometric curves and the ocular tension, visual field loss, and visual acuity. (3 figures, 11 tables, 9 references)

Walter Mayer.

Reeh, M. J. **Bilateral congenital glaucoma.** Tr. Am. Acad. Ophth. **65**:178-183, March-April, 1961.

Congenital glaucoma appears at birth or shortly thereafter. It is not due to failure of the chamber tissues to atrophy, but rather to failure of a specific active differentiation and orientation which results in cleavage. Photophobia, blepharospasm and epiphora should be looked for before the age of six months. Since they are intermittent, they can be missed. Once the disease has produced secondary changes

in the tissues, stromal haze, epithelial edema, splits in Descemet's membrane, and corneal opacification develop. Cupping occurs very late because of the distensibility of the infant's eye.

Instead of inserting into the scleral spur, the longitudinal fibers insert into the trabecular meshwork, and so fail to open the trabecular spaces and the canal of Schlemm. Eventually secondary changes occur in the meshwork and the canal. A case is reported, with histopathologic sections, in an infant who died a month after goniotomies. (2 figures, 5 references) Henry Horwich.

Schmidt, T. F. **On applanation tonometry.** Tr. Am. Acad. Ophth. **65**:171-177, March-April, 1961.

The applanation tonometer is based on measuring the force necessary to flatten a small corneal surface of constant size. Its chief virtue is that it eliminates the misleading impressions caused by abnormal ocular rigidity. A lesser advantage is that it is virtually free from error due to abnormal corneal curvature. Also, no tonographic effect is produced on repeated measurement. It reads directly in millimeters, and is independent of changing calibration tables. Instrument error is practically zero, and reading error is small if the instrument is used correctly. (6 figures, 2 tables, 19 references)

Harry Horwich.

Szabó, Z. **Experiences with Tosmilen eye-drops.** Szemészet **98**:7-12, 1961.

The author observed the tension-reducing effect of Tosmilen eye-drops in altogether 28 instances in 23 different glaucomatous patients. In 23 cases (82.2 percent) a considerable and lasting drop of tension was reached. The drug on the whole turned out to be well tolerated and severer side-effects did not occur. To the glaucomatous patients themselves, Tosmilen proved greatly advantageous for it can be instilled at longer intervals.

Gyula Lugossy.

Zoldan, T. **Two cases of secondary glaucoma due to occlusion of the central retinal artery.** Boll. d'ocul. **39**:484-490, 1960.

The author reports two cases of glaucoma thought to be secondary to an occlusion of the central retinal artery. In one of these the pressure was controlled by an iridectomy, performed by photocoagulation combined with a cyclodiathermy. (13 references)

Joseph E. Alfano.

## 10

### CRYSTALLINE LENS

Boberg-Ans, J. **Experience with twelve cases of intraocular anterior chamber implants for aphakia.** Brit. J. Ophth. **45**:37-43, Jan., 1961.

Monocular cataract extraction may result in considerable annoyance to the patient because of lack of binocular vision. In those patients requiring binocular vision and in whom the wearing of a contact lens is not satisfactory, it is recommended that the introduction of a plastic lens into the anterior chamber be considered. In this report 12 such patients are described using three different types of lenses. In all of these patients the procedure resulted in considerably more satisfaction than was previously experienced. The procedure for implanting the lens is briefly described. (figures, 14 references) Morris Kaplan.

Irvine, A. R. **Annual review. The lens and vitreous.** A.M.A. Arch. Ophth. **65**: 592-608, April, 1961.

The literature for 1960 and some from 1959 and 1958 is reviewed. (130 references) Edward U. Murphy.

Lurie, L. **Cataract extraction by expression.** Brit. J. Ophth. **45**:133-137, Feb., 1961.

Alpha chymotrypsin is used to mobilize the zonular fibers. Buttonhole iridectomies are performed at 11 and one-o'clock. The iris is intentionally prolapsed at 12-o'clock and the lens removed by expression. The iris is reposited with a spatula and the anterior chamber is reformed. Seven corneo-scleral sutures are used. Striate keratitis is avoided, which appears to be a complication of erisophake extraction and the tumbling technique of the forceps extraction. 190 cases are reported. (6 figures, 6 references)

Irwin E. Gaynon.

Tojo, H. and Uenoyama, K. **Study for the presence of 5-hydroxyanthranilic acid in the urine of senile cataract patients.** Jap. J. Ophth. **5**:67-75, Jan.-March, 1961.

The detection of 5-hydroxyanthranilic acid (5-OA) in the urine of patients with senile cataract was investigated by paper-chromatography and the respective amounts of 5-OA and its metabolic products in the urine after oral administration of anthranilic acid (AA) were measured by ion exchange chromatography.

Although specimens extracted with ethanol or butanol from the urine of senile cataract patients were studied by means of paper chromatography two-dimensionally, 5-OA or its conjugate form were not detectable. On the other hand, a peculiar spot was detectable on the paper-chromatographic development of samples extracted with ethanol but not of samples extracted with butanol. This spot was always detected in the patient's urine but not so frequently in the case of controls. The spot has no fluorescence with a positive ninhydrin reaction and an Rf value coinciding with that of tryptophan.

After the administration of 200 mg. of AA to senile cataract patients, 5-OA and its conjugate were not detected from 24-hourly collections of urine. In addition, anthanilic acid glucuronide and o-aminohippurinic acid were found in the urine of cataract patients in smaller amounts than in the urine of the controls.

The difference between the results obtained by Ogino et al. and these authors regarding 5-OA in the urine of senile cataract patients is discused. (6 figures, 4 tables, 14 references)

Authors' summary.

Zolotnekova, S. Y. **Extraction of immature nuclear cataracts.** Vestnik Oftal. **2**: 15-19, March-April, 1961.

The author cites 46 cases in which good vision was restored by performing an extra- and intra-capsular operation on immature nuclear cataracts. These cases are presented to refute the opinion that eyes with immature cataract should not be operated on. Benjamin Ziv.

## 11

### RETINA AND VITREOUS

Andreani, D. **A case of Bourneville's disease with involvement of the ciliary body.** Boll. d'ocul. **39**:319-328, 1960.

The author reviews the ocular findings in Bourneville's disease and presents a case of a 13-year-old white girl in whom, in addition to the typical retinal lesions, invasion of the ciliary body by two tuberous masses had also occurred. (3 figures, 30 references) Joseph E. Alfano.

Calmeltes, L., Deodati, F., Bec. P. and Bechac, G. **Fifteen cases with dysorique nodules of the retina.** Bull. et mem. Soc. franç. d'opht. **72**:252-273, 1959.

The dysorique retinopathy represents a characteristic entity. Ophthalmoscopically the specific nodules appear to be of a snow-white color, with a diameter of one-fourth to one-half the diameter of the disc. They always are located about the

disc, but never in the macular region. This explains the absence of visual impairment. They appear to be superficial, more or less prominent, and occasionally cover the course of a vessel. They may remain without change for many weeks; they finally break down gradually and disappear. Pathologically the lesions described were found to correspond to the fundus lesions; one type was identified in the nerve fiber layer; the other deep in the external plexiform layer. The histologic details and cellular differences between these two types of lesions, and of groups of lesions as seen in the better-known retinal diseases, were demonstrated on several slides. The exact etiology of this disease is unknown. A specific reaction of the vascular endothelium, that is, increase and decrease of its permeability, prevailing in the peripapillary area, because of its unique capillary structure was considered to be one of the main causes for this disease. These retinal nodules only were seen in debilitated and cachectic patients. The authors suggested systematic fundus examinations in gravely ill patients, to recognize the visible lesions as features of an isolated disease or in combination with fundus diseases of various origins. (10 figures, 11 references)

Alice R. Deutsch.

Canal, N. and DePoli, A. **The effect of a deproteinized blood extract on the metabolism of the retina (in vitro).** Boll. d'ocul. **39**:373-379, 1960.

The authors studied the effect of a deproteinized blood extract on the metabolism of the retina in vitro. It was found that perfusion of the retina with this extract enhanced the retinal metabolism as much as 40 percent. However, prolonged profusion produced the opposite effect. Addition of the extract did not affect the anaerobic glycolysis of the retina. (2 tables, 17 references)

Joseph E. Alfano.

Druault-Toufesco. **The importance of body weight in the vascular lesions of diabetes.** Bull. et mem. Soc. franç. d'opht. **72**:242-252, 1959.

Obesity is without any doubt one of the main factors which contribute to the development and aggravation of diabetic retinopathy. The author assembled a whole series of circumstances which emphasize the importance of weight control in the prevention of vascular lesions. He reviewed the etiology, clinical picture, pathogenesis, and therapeutic plans, and the diverse reasons why vascular manifestations sometimes precede, and sometimes follow clinical diabetes. He differentiates three forms of diabetes: 1. the juvenile diabetes which is caused by an insulin deficiency and is associated with hyperglycemia and ketosis, and the inability to utilize carbohydrates or to metabolize fats. The diabetes lipoplethorique is the diabetes caused by overeating and reacts favorably to a low calorie diet. Insulin is not essential in its treatment. The diabetes lipoatrophique is a rare anomaly. Fat cannot be stored and ingested glucose cannot be metabolized. There is either a scarcity or an absence of the lipolytic factor. It seems to be the duty of the attending ophthalmologist to instruct the patients on the importance of weight control.

Alice R. Deutsch.

Galin, M. A. and Baras, I. **Intravenous urea in retinal detachment surgery.** A.M.A. Arch. Ophth. **65**:652-656, May, 1961.

The adjunctive administration of this ocular hypotensive agent greatly facilitates retinal detachment surgery when used with the polyviol implant to secure scleral buckling. (2 figures, 4 references)

Edward U. Murphy.

Harris, W. **Pseudo-glioma due to larval choroidal-retinal granulomatosis.** Brit. J. Ophth. **45**:144-146, Feb., 1961.

The fifth case of retinal larval granulomatosis and pseudo-glioma is reported. (3 figures, 1 reference)

Irwin E. Gaynon.

Hill, R. V., Rich, O., Swan, K. C. and Weeks, D. **A new electronic instrument for precise surgery for retinal detachment.** A.M.A. Arch. Ophth. **65**:680-683, May, 1961.

Variations in impedance of the various ocular tissues prevent accurate application of measurable heat injuries with conventional equipment. The instrument described here delivers precise amounts of radio-frequency energy to the eye for cyclodiathermy or retinopexy. (1 figure, 8 references) Edward U. Murphy.

Klein, B. A. **Annual Reviews. Retina and optic nerve.** A.M.A. Arch. Ophth. **65**: 717-769, May, 1961.

The literature for 1959 and 1960 is summarized. (433 references)

Edward U. Murphy.

Klöti, R. **The indications for light coagulation in retinal lesions.** Ophthalmologica **141**:181-189, Feb., 1961.

A general discussion without reference to specific case material is presented. An effort is made to show the rationale for choosing either light coagulation or transcleral diathermy for the treatment of various retinal lesions. In general it is felt that light coagulation is indicated when the coagulation area must remain small and when maximum preservation of the normal surrounding structures is desired, when the amount of coagulation must be exactly delivered, when coagulation must be in many different areas or at the posterior pole, when the vitreous must remain clear, and when there is little or no retinal elevation. It is not indicated when a scleral shortening effect is wanted, when there is much atrophy (and depigmentation, with consequent poor light absorption) of the choroid and retinal pigment epithelium, when extensive coagulation is desired, and when there is an extensive retinal detachment.

Special problems are then discussed, such as prophylactic ringing of dangerous retinal lesions (which the authors consider the chief indication for light treatment), macular holes (where they believe light coagulation is almost invariably contraindicated), and retinoschises (where progression of the lesion should be halted by a barrier of coagulation, but *only* when a definite progression has been confirmed during a period of observation). (2 tables, 4 references) Lawrence T. Post.

Kuwabara, T., Carroll, J. M. and Cogan, D. G. **Retinal vascular patterns. Part III. Age, hypertension, absolute glaucoma, injury.** A.M.A. Arch. Ophth. **65**:708-716, May, 1961.

The retinal vessels were studied after removing other tissues by means of trypsin digestion and gentle agitation. The deviations from the normal pattern in the above-named conditions are described. (7 figures, 4 references)

Edward U. Murphy.

Shimizu, Koichi. **Mottled fundus in association with pseudoxanthoma elasticum.** Jap. J. Ophth. **5**:1-13, Jan.-March, 1961.

The author discussed a fundus change which he refers to as "mottled fundus" and which is characterized by minute yellow spots and pigmented patches. In four patients this fundus lesion occurred with pseudoxanthoma elasticum of the skin. In one patient it occurred with angioid streaks as well. The mottled fundus is one of the chief components of the Grönblad-Strandberg syndrome whether angioid streaks are noted or not. It seems to be the earliest sign, appearing before the angioid streaks become evident.

The Japanese literature on angioid

streaks is briefly surveyed. (3 figures in text, 8 figures on color plates, 2 tables, 21 references) Author's summary.

Smith, J. L. **Central retinal and internal carotid arterial occlusions.** A.M.A. Arch. Ophth. **65**:550-552, April, 1961.

The ophthalmodynamometer can differentiate between these two conditions which produce virtually identical ophthalmoscopic findings since it measures ophthalmic artery pressure and not that of the central retinal artery. (7 references)

Edward U. Murphy.

Tamler, E. and Eissler, R. **The intraocular pathology in Schilder's disease.** A.M.A. Arch. Ophth. **65**:514-516, April, 1961.

A case is reported in which there was a very marked loss of retinal ganglion cells, severe alteration of the nerve fiber layer, and optic nerve atrophy. (1 figure, 2 references) Edward U. Murphy.

Toussaint, D., Kuwabara, T. and Cogan, D. G. **Retinal vascular patterns.** A.M.A. Arch. Ophth. **65**:575-581, April, 1961.

The technique of trypsin digestion was employed in this study. Three-dimensional preparations reveal patterns not possible in two-dimensional preparations. (8 figures, 3 references)

Edward U. Murphy.

Winkelman, T. E. and Horsten, G. P. M. **The electro-retinogram of the newborn.** Bull. et mem. Soc. franç. d'opht. **72**: 236-241, 1959.

The retina of the dog is not completely differentiated at birth, while the human retina is well differentiated, with exception of the macula. In this interesting study the anatomic development and the functional development of the retina were investigated by comparing the ERG of one eye with histological sections of the other eye. Two litters of dogs were used in this experiment. The ERG was done in one eye on the 3rd, 6th, 10th, 12th, 15th, 18th, 20th, and 31st day after birth, while the other eye was enucleated at the same time. In the dog the retinal differentiation progresses from the center to the periphery. The first manifestations of an ERG were visible at a very early stage of development, probably after the tenth day.

Adequate manifestations in the technique of the ERG had to be made to adapt the procedure to the special requirements. The same technique was used in about ten infants 48 hours after birth. Special small contact lenses were utilized. The children were put into a dark box to achieve the necessary dark adaptation. The stimulatory light was imbedded in the box. In every case, even in the premature infant, the authors were able to get a tracing. The ERG consisted of a preliminary negative phase, followed by a positive B potential. The similarity with the mammalian ERG was striking. (5 figures) Alice R. Deutsch.

## 12

### OPTIC NERVE AND CHIASM

Jain, N. S. **Two-stage intracranial and orbital operation for glioma of the optic nerve.** Brit. J. Ophth. **45**:54-58, Jan., 1961.

Many neurosurgeons prefer the intracranial approach for removal of all orbital tumors because much fewer ocular complications occur; some however prefer the lateral orbitotomy approach. Jain describes a case in which a two-stage combined intracranial and lateral orbitotomy was performed for the removal of a large glioma of the optic nerve in a 12-year-old child. The tumor seemed to have been removed entirely but blindness of the second eye, presumably by transchiasmal extension, followed within a few months. (5 figures, 36 references)

Morris Kaplan.

deVeer, J. A. **Melanotic tumors of the optic nerve head.** A.M.A. Arch. Ophth. **65**:537-541, April, 1961.

A case is reported in which serial sectioning showed that the tumor was confined entirely to the optic disc and nerve. There was no involvement of the choroid. The author discusses this rare type of melanoma and points out how few of these have been conclusively proved in the literature. (5 figures, 16 references) Edward U. Murphy.

## 13

### NEURO-OPHTHALMOLOGY

Capaccini, A. and Pizzetti, F. **Neuro-ophthalmologic complications in cardiac surgery.** Riv. oto-neuro-oftal. **36**:53-68, Jan.-Feb., 1961.

The authors present the case histories of three patients who were subjected to mitral commissurotomy. Perimetric studies subsequent to the surgery revealed hemianopic defects in each patient. The authors review the literature and attempt to interpret the findings in their own cases. They believe that the pathogenesis of the field defects lies in a hypoxia arising during the operation. (6 figures, 35 references) Wm. C. Caccamise.

Kunkle, E. C. and Anderson, W. B. **Significance of minor eye signs in headache of migraine type.** A.M.A. Arch. Ophth. **65**:504-508, April, 1961.

The authors studied 98 patients with a common migraine variant: unilateral anterior headache occurring in the cluster pattern. Of these patients 75 percent showed injection of the bulbar conjunctiva and excessive lacrimation during the attack which was limited to the side of the pain. Seven had miosis of the ipsilateral pupil during the headache and eight additional patients showed a chronic miosis on the same side. Ptosis was observed in six cases. The authors speculate on the site of the disturbance and group these minor eye signs under the headings of parasympathetic discharge and sympathetic paralysis. (3 figures, 19 references) Edward U. Murphy.

Lanie, E. and François, P. **Three case histories of aneurysms of the internal surface of the internal carotid with intrasellar extension.** Bull. et. mem. Soc. franç. d'opht. **72**:187-197, 1959.

Aneurysm of the internal surface of the internal carotid artery is very rare. Only three cases of this kind were found among 200 endocranial aneurysms observed at the neurological service of the City Hospital at Lille. These aneurysms eroded the lateral wall of the sella and simulated a pituitary adenoma. Posterior compression of the chiasm, more pronounced on one side, was the most important ophthalmologic sign. Absence of any other ophthalmologic defect also was considered to be a characteristic detail. In spite of the occasional huge size of the aneurysm there were no metabolic disturbances of the pituitary. Vascular changes, on the contrary, were very pronounced. The aneurysms were considered to be of atheromatous and not of congenital origin. Calicified plaques were visible in the vessel walls. The diagnostic significance of radiologic studies and air studies are also discussed. The potential hazards of angiography and the risks of surgical explorations and interventions were demonstrated in reviewing the pertinent case histories. Alice R. Deutsch.

Smith, J. L., Nashold, B. S. and Kreshon, M. J. **Ocular signs after stereotactic lesion in the pallidum and thalamus.** A.M.A. Arch. Ophth. **65**:532-535, April, 1961.

This recently developed surgical technique places lesions in localized areas of the central nervous system for the relief of paralysis agitans and intractable pain.

In the four cases reported here adjacent structures were apparently involved during surgery and the patients showed other neurologic signs not present preoperatively. These included nystagmus retractorius, quadrantanopias, and paresis of conjugate gaze. (7 references)

Edward U. Murphy.

Szarvasy, Gy. and Schéda, V. **Teleangiectatic ataxia (Louis-Bar syndrome).** Szemészet **98**:23-28, 1961.

The authors discuss a case of teleangiectatic ataxia, also called the Louis-Bar syndrome. The disorder, a member of the phakomatosis group, is characterized by the triad of the following symptoms: cerebellar ataxia, oculo-cutaneous teleangiectasies, and bronchiectasy or sino-pulmonary diseases. The present case is the twenty-fourth in the literature.

Gyula Lugossy.

## 14

### EYEBALL, ORBIT, SINUSES

Cavalheiro, Willmersdorf, J. and Renata Attadia, E. **Luxite implant in evisceration.** Arq. brasil. oftal. **23**:145-148, 1960.

The authors report their observations on the insertion of a plastic implant in 25 cases of evisceration. The Ruedemann technique of scleral incision was followed. The size of the implant varied from 18 to 20 mm. A prosthesis was applied to the anterior surface of the globe three months after surgery. The final result was highly successful from a cosmetic standpoint. (4 figures, 1 reference) James W. Brennan.

Cogan, D. G. and Kuwabara, Toichiro. **Orbital reaction of sponge (Ivalon) implant.** A.M.A. Arch. Ophth. **65**:646-647, May, 1961.

The reaction was not apparent until two years after enucleation and suggested a recurrence of the original retinoblastoma. A portion of orbital tissue was removed and studied histologically. (2 figures, 9 references) Edward U. Murphy.

Gillian, L. A. **The collateral circulation of the human orbit.** A.M.A. Arch. Ophth. **65**:684-694, May, 1961.

The injection technique for studying vascular anatomy leads in this study to the conclusion that 90 percent of individuals have a collateral blood supply to the orbit adequate to prevent permanent blindness after a major obstruction of the internal carotid artery or the ophthalmic artery. Several possible communications between the internal and external carotid systems through the orbit exist. The commonest is an accessory ophthalmic artery branching from the middle meningeal. (3 figures, 2 tables, 28 references)

Edward U. Murphy.

Gonzalez-Ulloa, M. and Stevens, E. **The treatment of palpebral bags.** Plast. Reconstr. Surg. **27**:381-396, April, 1961.

Blepharochalasis, or senile fold of the eyelid, is to be differentiated from palpebral bags, the correction of which is the subject of this paper. The authors believe that palpebral bags are formed by an increase of the orbital adipose tissue and by weakening of the orbital septum, miopragia of the orbicularis muscle and distention of the skin.

They recommended that all four lids should be corrected if they are involved, and that the appearance of a young eye should be restored by lengthening the palpebral fissure by making a peripheral resection of the skin over a lateral compensatory triangle. This step erases the wrinkles from the lateral angle of the eye and will simultaneously balance the length of the incision and the lateral palpebral commissure. In their experience this avoids the possibilities of an ectropion. The procedure is continued by making an incision through the orbicularis muscle and the orbital septum near the

orbital rim; by applying pressure on the globe, they press out some of the fat behind the orbital septum. The tonus of the orbital septum is restored by careful suturing of this structure. When there is laxity of the facial muscles, a simultaneous rhytidectomy should be performed.

Alston Callahan.

Katlan, N. R. and Griffin, W. R. **Osteoma of the orbit.** A.M.A. Arch. Ophth. **65**:542-545, April, 1961.

The successful removal of an unusually large orbital osteoma in a 73-year-old man is reported. (5 figures, 11 references)

Edward U. Murphy.

Melanovski, W. H. **Simple orbitotomy in intra-orbital nerve tumors.** Bull. et mem. Soc. franç. d'opht. **72**:220-223, 1959.

Simple orbitotomy as compared to the Krönlein type of operation has been a controversial issue for many years. The author prefers the simple orbitotomy in most cases because of the shortness in the time of recovery, better scar formation and easier technique, especially in the young flat orbit. The author also believes that the exposure of the spongy bone substance is a potential hazard towards the propagation of tumor cells. Whenever an optic nerve tumor extended towards the apex of the orbit and the optic canal, he favored the transcranial approach to the orbit. The discusser, Vergez, however, endorsed the temporal approach, because of the better exposure, greater safety and promotion of complete resection of tumors of various origin. (9 references) Alice R. Deutsch.

Mergier, J. **Cholsteatoma of the pterygoid.** Bull. et mem. Soc. franç. d'opht. **72**: 224-230, 1959.

Anatomy, topographic anatomy, pathogenesis, classification and differential diagnosis of cholesteatomas of the minor wing of the sphenoid are discussed. Special emphasis is placed on two clinical signs, mild monocular exophthalmos and intermittent swelling of the collateral temporal region. The surgical prognosis of subdural epidermoid cysts is not considered to be very good. Diploic epidermoid cysts however have an excellent prognosis. The surgery is not difficult and total exstirpation is practically always possible. The case history of a 42-year-old man is given. He presented himself with an intermittent monocular lid and temporal fossa edema. There was also a mild exophthalmos. The diagnosis was only made several months later, after clinical and radiologic findings could be coordinated and stabilized. Surgery was successful, with only a mild exophthalmos remaining. (36 references) Alice R. Deutsch.

Nagy, F., Farkas, I., Stefanics, J. and Erdélyi, M. **Supraorbital torus.** Szemészet **98**:29-31, 1961.

The authors describe a case of highly disfiguring supraorbital torus (protuberance), found in a male patient, aged 12 years. No other signs of developmental abnormality were detectable. Surgical intervention produced satisfactory results.

Gyula Lugossy.

Viallefont, H., Paleirac, R. and Bondet, C. **Radiological examination of the cavernous sinus.** Bull. et mem. Soc. franç. d'opht. **72**:208-219, 1959.

Extensive studies of the radiologic presentation of the orbital venous system verified recent anatomic findings concerning the structure of the cavernous sinus. In the past the cavernous sinus was considered to be a pool of blood in which various structures such as the internal carotid artery and groups of nerves were immersed. Anatomic dissections however, proved that this was not true, that the sinus consisted of a meshwork of well differentiated individual veins, every one having its own particular wall. This ven-

ous system was fed not only by the inferior and superior orbital veins but also by the pituitary veins, the veins from the sphenoparietal sinus, collateral veins from the opposite orbit and from some extracranial branches at the base of the skull. Three types of groupings were found on both anatomic and radiologic investigation. In group I the cavernous sinus presents one huge single vein; in group II several branches of veins run parallel in antero-posterior direction, and in group III there is a dense meshwork of veins. These anatomic and radiologic details must be well understood when orbital venograms are interpreted. Venograms will be of increasing diagnostic significance in diseases of the orbit and corresponding venous plexuses. The authors used a slightly modified technique as compared with former studies. It was found to be very disturbing to have the subcutaneous venous bed of the face filled with the injected contrast liquid. By not ligating the emissary veins to the angular veins the technique was not only simplified but the filling of unessential venous spaces was also made less disturbing. (19 figures, 13 references)

Alice R. Deutsch.

## 15

### EYELIDS, LACRIMAL APPARATUS

Burn, R. A. **End-to-side anastomosis for obstruction of the naso-lacrimal duct.** Brit. J. Ophth. **45**:117-124, Feb., 1961.

The pumping action of the orbicularis muscle is stopped by the usual medial lacrimal sac wall operation. The naso-lacrimal duct is mobilized. The obstruction is excised. The proximal end of the patent duct is then sutured to the trephine opening in the nasal mucosa. The anatomy of the lacrimal sac is not altered. There is no uncovered intranasal bone. The suture lines do not adhere. There must be no pathology in the upper lacrimal sac or the sinus of Maier. The technique and management are described. (11 figures, 1 table, 11 references)

Irwin E. Gaynon.

Fasanella, R. M. and Servat, J. **Levator resection for minimal ptosis. Another simplified operation.** A.M.A. Arch. Ophth. **65**: 493-496, April, 1961.

A rapid and simple method of excising levator, tarsus, and Müller's muscle is described for patients with 4-mm. or less of ptosis. A fair lid fold and levator action should be present preoperatively. (7 figures, 7 references)

Edward U. Murphy.

Ffooks, O. O. F. **Pathology and treatment of non-cicatricial entropion by the method proposed by Wies.** Brit. J. Ophth. **45**:130-132, Feb., 1961.

Senile entropion is caused by the excessive movement of the orbicularis muscle over the tarsal plate. There is associated senile atrophy of the palpebral connective tissue and a weakened tarsal plate.

A small incision is made three millimeters below the lid margin, cutting through all structures. The lower tarsus is resutured so that the lower lip rides over the upper portion. The development of fibrous tissue between the tarsal plate and skin relieves the entropion. (10 references)

Irwin E. Gaynon.

Fox, S. A. **Lid halving with variations.** A.M.A. Arch. Ophth. **65**:672-679, May, 1961.

Wheeler's classical halving procedure is described and several variations are discussed and illustrated. (8 figures, 4 references)

Edward U. Murphy.

Mastman, G. J., Baldes, E. J. and Henderson, J. W. **The total osmotic pressure of tears in normal and various pathologic conditions.** A.M.A. Arch. Ophth. **65**:509-513, April, 1961.

The normal variation is rather wide and tears from patients with various pathologic conditions fall within this range. Even keratoconjunctivitis sicca shows only a small increase. The authors conclude that there is little need to alter the tonicity of ophthalmic solutions in the treatment of various diseases. (2 tables, 10 references) Edward U. Murphy.

Sarda, R. P., Kulshrestha, O. P. and Mathur, R. N. **Dacryocystorhinostomy.** Brit. J. Ophth. **45**:138-143, Feb., 1961.

The authors describe their technique for dacryocystorhinostomy. A special needle used in suturing the flaps of the medial wall of the lacrimal sac to the nasal mucosa is described. It combines the advantages of the miniature aneurysmal needle and Reverdin's needle. Laceration is infrequent. (2 figures, 1 table, 8 references) Irwin E. Gaynon.

## 16

### TUMORS

Cogan, D. G., Poppen, J. L. and Hicks, S. P. **Ganglioneuroma of chiasm and optic nerves.** A.M.A. Arch. Ophth. **65**:481-482, April, 1961.

This is the only reported case of its kind. These tumors are usually found in the posterior mediastinal and retroperitoneal regions. The patient is a 10-year-old girl who has survived after partial excision and X-ray therapy four years ago. (2 figures, 5 references)

Edward U. Murphy.

Cowan, T. H. and Balistocky, M. **The Nevus of Ota or oculodermal melanocytosis.** A.M.A. Arch. Ophth. **65**:483-492, April, 1961.

Patients with this condition show a distinctive pigmentation of the facial skin commonly combined with pigmentation of the globe. Four cases are reported here. Although the lesions may progress they are never malignant. (6 figures, 1 table, 29 references)

Edward U. Murphy.

Manchester, P. T. **Retinoblastoma among offspring of adult survivors.** A.M.A. Arch. Ophth. **65**:546-549, April, 1961.

Retinoblastoma seems to occur in two forms, one transmitted in the usual autosomal inheritance wherein 50 percent of the children are affected. The germ cells do not appear to be involved in the other type and survivors do not pass the condition on to their offspring. The results of the present study fit well with this concept and 10 affected individuals were found among 34 children of survivors. (4 figures, 4 tables, 10 references)

Edward U. Murphy.

McWilliam, R. J. **Delayed local metastasis in a choroidal melanoma.** Brit. J. Ophth. **45**:147, Feb., 1961.

A localized recurrence of a choroidal melanoma in the orbit 16 years after enucleation is reported. (1 reference)

Irwin E. Gaynon.

Mortada, Aly. **The histogenesis of orbital endotheliomata.** A.M.A. Arch. Ophth. **65**:636-645, May, 1961.

Two cases of angioendothelioma and two of meningioendothelioma were studied histopathologically. Many similarities and the differences were noted in these lesions and endothelioma of other structures which are ascribed to their different sites of origin. The various tumors of this type probably all arise from embryonic endothelial cells. (26 figures, 29 references) Edward U. Murphy.

## 17

### INJURIES

Queiroga, G. **Intraorbital foreign bodies.** Arq. brasil. oftal. **23**:149-154, 1960.

Intraorbital foreign bodies are of major

importance in the field of trauma to the eye and adnexa. The orbit is divided by the orbital septum into an anterior portion containing the globe and its adnexa, and a posterior portion containing the muscles, nerves, vessels and orbital fat. Foreign bodies in this posterior portion are fairly well tolerated by the tissues, and one is reluctant to attempt surgical removal because of inaccessibility. Intraocular foreign bodies on the other hand represent a serious threat to the globe in most instances and require extraction if possible.

Prior to surgical intervention, radiographic localization of the foreign body and identification of the magnetic qualities of the particle should be done. Nonmagnetic particles may be extracted by forceps inserted into the globe under direct visualization. Magnetic particles are extracted with the giant electromagnet through an incision nearest the foreign body. This may be either anterior or posterior, as the case may be. This procedure minimizes surgical trauma.

The prognosis depends upon the size of the particle, its nature and location. In general, the prognosis is guarded or poor, especially in cases of particles posterior to the lens. (7 figures, 3 references)

James W. Brennan.

Smith, V. H. **Pressure changes in the ophthalmic artery after carotid occlusion.** Brit. J. Ophth. **45**:1-26, Jan., 1961.

In cases of carotid artery occlusion, eye signs of homolateral blindness and crossed hemianopic field defects may be the only early clues and the ophthalmologist may have the primary responsibility for diagnosing the condition. Several studies on the variations in pressure changes in the ocular vessels in this condition have been reported but the results have not been entirely satisfactory. In this study several changes in laboratory techniques have been used. In the original Duke-Elder procedure a pressure needle is inserted into the ophthalmic artery whereas in this series a blue vital dye was injected into the general circulation of the anesthetized rabbit after the intraocular pressure has been raised to well above the general blood pressure. At the end of each experiment, the animal was killed and the eye fixed in formalin for tissue studies.

In the control experiments it was shown that the normal pressure in the ophthalmic artery is within 5 mm. Hg of the general blood pressure. The average systemic blood pressure in the 66 rabbits measured 108 mm. Hg. Ligation of the common carotid artery produced a fall in the blood pressure of 50 percent distal to the occlusion whereas the ophthalmic artery pressure held the same 5 mm. Hg variation from this altered blood pressure. The blood circulating in the Circle of Willis was found to have no pulse pressure; the blood passed through the cannula without pulsations.

Carotid artery thrombosis was found to be present in 3 percent of 1,400 unselected autopsies and the condition had not been suspected during life; in cases of carotid occlusion below the level of the ophthalmic artery, only a third showed any cerebral damage. Clinically the disease may be either explosive and fatal or very slowly progressive with or without symptoms. The most common site of the occlusion was found to be in the internal carotid artery just distal to the carotid sinus and the visual symptoms may be a transient amaurosis or a progressive optic atrophy and both may be of varying degrees. Diagnosis is made by angiography or ophthalmodynamometry. (109 references) Morris Kaplan.

## 18

### SYSTEMIC DISEASE AND PARASITES

Allen, R. A., O'Malley, C. and Straatsma, B. R. **Ocular findings in hereditary**

**ochronosis.** A.M.A. Arch. Ophth. **65**:657-668, May, 1961.

This is the second report in the literature of a case of hereditary ochronosis in which the eyes were examined pathologically. Extensive scleral pigmentation was localized near the insertions of the extraocular muscles. Some pigment was found in the uveal tract but the cornea, lens, vitreous, and retina were free of discoloration. The pathology in other organs of the body was described. (20 figures, 25 references) Edward U. Murphy.

Balakrishnan, E. **Bilateral intra-ocular cysticerci.** Brit. J. Ophth. **45**:150-151, Feb., 1961.

A case of bilateral intraocular cysticerci is reported. Surgical removal of the live cysts was successful. Extensive chorioretinitis proliferans was present. (2 figures) Irwin E. Gaynon.

Myerson, L. and Pienaar, B. T. **Intraocular cysticercus.** Brit. J. Ophth. **45**:148-149, Feb., 1961.

A case of cysticercus cellulosae in a 21-year-old African female is presented. Retinal photographs show movement of the live larva. (3 figures) Irwin E. Gaynon.

Pestalozzi, D. and Martenet, A. C. **A case study of temporal arteritis with eye involvement.** Ophthalmologica **141**:155-180, Feb., 1961.

Eleven cases are described in detail. From these is reconstructed a general, clinical picture of the ocular disease. The prodromals consist of vague feelings of fatigue, loss of appetite, weight loss, rheumatic symptoms, and finally headache. The headache can be diffuse, nuchal, frontal, or temporal. With only one exception, the interval between the onset of the headache and the visual symptoms was no greater than six weeks; however, the period between the first prodromal symptoms of malaise and the visual disturbances could be much longer (in one case, eight months). The temporal arteries are not invariably involved, being spared in three of these 11 cases; in six cases they were hardened and pulseless, in one case, acutely inflamed. The fundus picture varies with the site of aterial occlusion, three distinct pictures (and combinations of these) being possible: 1. occlusions of arteries in the region of the circle of Zinn directly behind the lamina cribrosa produce edema and pallor of the nerve head, and if, in addition, a ciliary artery or cilioretinal vessel is occluded, a pale, edematous, segmental area of retina corresponding to the distribution of this vessel will appear; 2. occlusion of the central retinal artery usually leads to the typical picture of this condition, but if the block occurs gradually, the picture may be somewhat atypical; and 3. occlusion of the retrobulbar, nutrient vessels of the optic nerve may lead to profound loss of vision with surprisingly little apparrent change in the disc and retina (only a little edema and a minimal pallor).

In four cases the temperature was normal, in six slightly elevated, and in one definitely elevated. The sedimentation rate was accelerated in all cases to 40 mm. in one hour or more. This was associated with a decrease in serum albumin and an elevated alpha-2 and beta-globulin. There were two cases of moderate and six of marked hypochromic anemia. The white count was moderately elevated in two cases, but in four there was a definite shift to the left.

The authors are convinced that steroid treatment is effective if instituted prior to truly profound visual loss. High steroid dosages are recommended for periods of at least one year. Surprisingly, they agree with a previously expressed opinion that excision of both temporal arteries is not only of diagnostic importance but *therapeutic*! (7 figures, 7 tables, 11 references) Lawrence T. Post.

Shikano, Shin-ichi. **A histopathologic study of Behçet's disease.** Jap. J. Ophth. **5**:54-67, Jan.-March, 1961.

Histomorphologic studies on the symptoms of Behçet's disease, such as erythema nodosum, thromboangiitis obliterans, purulent eruption, epididymitis, arthritis and aphtha were carried out. The results indicate that the inflammations have common features with fibrinoid degenerations of connective tissue and blood vessels, and abundant excessive reformation of collagen fibers in a later stage. Furthermore, the examination of 14 eyeballs showed that the intraocular inflammations were of similar nature.

A disease in which these inflammations attack various parts of the body in a scattered way is generally known as collagen disease. Behçet's disease, therefore, is one of the typical collagen diseases. (25 figures (5 in color), 14 references)

Author's summary.

## 19

### CONGENITAL DEFORMITIES, HEREDITY

Rodegena, A. M., Yegorov, E. F. and Koctyouk, A. N. **Congenital toxoplasmosis of the eye.** Vestnik Oftal. **1**:45-52, Jan.-Feb., 1961.

Congenital toxoplasmosis, which occurs either during pregnancy or in the first months after birth, disturbs the normal development of the embryo and results in deformities and anomalies of the central nervous system and the eye. Those children who survive are physically and mentally retarded. With the typical symptom complex of congenital toxoplasmosis, the authors have observed that the hyaloid artery is intact in three out of six children. In the cases studied, the complement reaction for toxoplasmosis was positive in children over three years old. Mothers with children younger than three years also showed a positive complement reaction for toxoplasmosis. (4 figures, 14 references)

Benjamin Ziv.

## 20

### HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Bruna, F. **A review of Latin-American ophthalmology for the year 1948.** Boll. d'ocul. **39**:526-555, 1960.

The author reviews Latin-American ophthalmology for the year 1948. (79 references)

Damato, F. J. **The fight against trachoma in the island of Malta.** Brit. J. Ophth. **45**:71-74, Jan., 1961.

Fifty years ago trachoma was the most widespread ocular disease in Malta whereas today it is virtually eliminated. Through the years this was accomplished by a general improvement in economic and public health conditions of the people but principally it was accomplished by rigid use of prophylactic and therapeutic procedures at the grade school level in infected children in whom control could much better be exercised. (1 reference)

Morris Kaplan.

Leonardi, F. **A review of ophthalmology in Germany in the year 1958.** Boll. d'ocul. **39**:443-474, 1960.

The author presents a fairly comprehensive review of ophthalmology in Germany during the year 1958. (181 references)

Joseph E. Alfano.

Sherman, A. **Visual hygiene.** Rev. brasil. oftal. **20**:101-111, March, 1961.

The author reviews the industrial eye accidents in his home town of Rio Alegre in Brazil. In three years there were 1,184 eye accidents and 206 of these resulted in industrial blindness in either one eye or both. He feels that good illumination will reduce the incidence of eye accidents and that at certain times of the day and

at certain seasons of the year it is essential to supplement the solar light with artificial light. The wearing of safety lenses will also greatly reduce ocular accidents. Walter Mayer.

Verrey, F. **A meeting with George Bartisch, an oculist of the sixteenth century.** Ophthalmologica **141**:81-99, Feb., 1961.

This is a well-written, interesting, and amusing discussion of a treatise written by a sixteenth century eye surgeon, describing ophthalmologic concepts, surgical procedures, and treatments of this era. (6 figures) Lawrence T. Post.

## Ophthalmic Miniature

From the clinical observations presented and from the considerations made, it seems to me that we must conclude:

1. The incision of the tissue in the chamber angle forms the operation *of choice* for the treatment of hydrophthalmos. This operation, besides having the immediate effect of a more or less permanent lowering of the tension, has the extreme advantage of being applicable also when the strong distension of the ocular coats and the consequent alteration in the area of the zonule of Zinn make other operations impractical, without serious damage to the eye.

2. Conforming to the principal alterations found in the chamber angle of the majority of buphthalmos cases, the mentioned incision has its action on the altered or abnormally developed structures of the chamber angle, thus improving conditions for the filtration of the eye.

3. The operation should be done with the knife of Prof. De Vincentiis and not with the modification after Valude; it is even worse to use a Graefe knife.

Dr. Noe Scalinci, "The incision of the tissue in the chamber angle in hydrophthalmos, *Annali di Ottalmologia*, **29**:347, 1900.

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## Notice

The International Council of Ophthalmology allocated 5,000 Swiss francs in order to help defray the expenses of individuals who are not in private practice and are contributing papers or officially taking part in the scientific program of the XIX International Congress of Ophthalmology, New Delhi, India, December, 1962. Applications should be forwarded to the Secretary of the Council, Dr. Edward Hartmann, 2 Avenue Ingres, Paris (16°), France, before November 30, 1961.

# NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, Cincinnati, Ohio

News items should reach the editor by the 10th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

## DEATHS

Dr. Macks Leonard Bergman, Los Angeles, California, died December 18, 1960, aged 52 years.

Dr. Richard Omri Bullis, Jr., Los Gatos, California, died January 9, 1961, aged 37 years.

Dr. Robert Weller French, Melrose, Massachusetts, died February 1, 1961, aged 76 years.

Dr. Carroll Richard Mullen, Philadelphia, Pennsylvania, died February 1, 1961, aged 60 years.

Dr. Ruskin Gregory Anderson, Spartanburg, South Carolina, died December 30, 1960, aged 53 years.

Dr. William Feuilleteau Bonner, New Orleans, Louisiana, died December 27, 1960, aged 76 years.

## ANNOUNCEMENTS

### PAN-AMERICAN INTERIM MEETING

The next interim meeting of the Pan-American Association of Ophthalmology will be held in Lima, Peru, January 28-February 3, 1962.

The subject matters under consideration will be the following:

1. Diagnosis and medical treatment of glaucoma
2. Present steroid therapy in ophthalmology
3. Corneal conditions and their treatment
4. Round-table conference concerning retinal lesions

A request is made for motion pictures of interest pertaining to any of these subjects. Anyone interested in presenting a motion picture at the scheduled meeting should mail it to A. Benedict Rizzuti, M.D., chairman, Scientific Movies, Pan-American Association of Ophthalmology-1962, 160 Henry Street, Brooklyn 1, New York, at the earliest convenience for review and consideration. Preference will be given to those physicians who are planning to be present at the meeting or in cases where the films are of unusual interest.

### RETINAL DETACHMENT COURSE

A course on "Retinal detachment" will be presented at the Presbyterian Medical Center in San Francisco on September 4th, 5th, and 6th, under the chairmanship of Dohrmann K. Pischel, M.D. The fee is $100.00. Enrollment is limited. Address inquiries to: Secretary, Presbyterian Medical Center Eye-Bank, 2018 Webster Street, San Francisco 15, California.

## SOCIETIES

### SOUTHEASTERN SECTION

The Southeastern Section of the Association for Research in Ophthalmology will hold its next meeting at Duke University Medical Center January 12-13, 1962. Abstracts should be submitted to J. Lawton Smith, M.D., assistant professor of ophthalmology, Duke University Medical Center, Durham, North Carolina, before December 1st.

### AOS OFFICERS

At the recent meeting of the American Ophthalmological Society, the following officers were elected for the coming year: President, Dr. Francis Heed Adler; vice president, Dr. Paul A. Chandler; secretary-treasurer, Dr. Joseph A. C. Wadsworth; editor of *Transactions*, Dr. M. Elliott Randolph.

### MILWAUKEE OFFICERS

At the annual meeting of the Milwaukee Oto-Ophthalmic Society, the following officers were elected: George J. Roncke, M.D., president; Charles J. Finn, M.D., vice president; Arvid G. Holm, M.D., secretary-treasurer.

## PERSONAL

Dr. Shaler Richardson, Jacksonville, Florida, was awarded the Certificate of Merit of the Florida Medical Association, at the 87th annual meeting of the association. Dr. Richardson, editor of the *Journal* of the Florida Medical Association for 33 years, is the second member of the association to receive this honor.

See the special notice on page 321.

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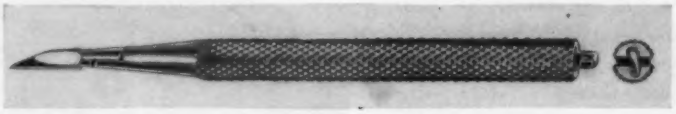

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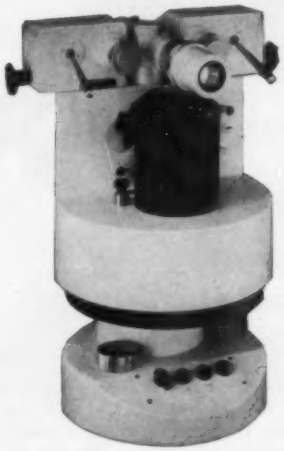

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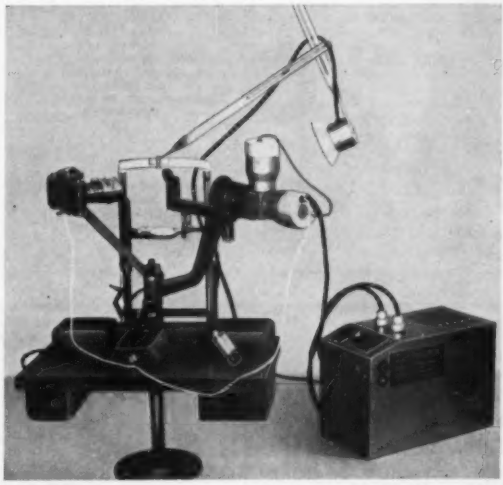

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